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Battelle Technical Review

IN THIS ISSUE: Can We Predict The State of The Art?

VIGNETTE

JOHN G. KURA

"This may be an age of specialization," states John G. Kura, "but the scientist and engineer cannot safely allow himself to be limited to the ever-narrowing confines of his field. His effectiveness is often determined by his knowledge of developments in other areas, for out of such knowledge usually come new concepts that might otherwise never have been conceived." In most cases, John believes, new concepts grow out of the experience and knowledge, both special and general, of the individual.

Knowledge of developments outside his own field has been helpful to John in research studies on nonferrous melting and casting problems. It contributed to his pioneering work in the development of controlled-atmosphere, cold-crucible furnaces, of both consumable-electrode and induction-melting types. These were devised for melting both conventional and refractory metals. His broad knowledge was useful also in his 12-year study of the fluid-flow characteristics and basic principles of gating systems. This study has led to significant improvement in the commercial casting of metals.

John has played a key role in the creation of a new process for cladding high-strength steel wire with a thick coating of aluminum. The product is already being used successfully for electrical transmission lines. In earlier studies, he participated in the development of bimetallic bonding and cladding techniques for use in producing nuclear reactor fuel elements. He has been associated, too, with research on the effects of gases on nonferrous alloys; the development of a high-strength, high-conductivity zirconium-copper alloy and of highly wear-resistant foudrinier wire; the invention of an inert mold material for casting titanium; and the study of dip-galvanizing and aluminizing coating processes.

A native of Pittsburgh, John began his professional career as a metallurgical observer at the Duquesne Works of the Carnegie-Illinois Steel Corporation. This association followed his graduation from Carnegie Institute of Technology with a B.S. degree in metallurgical engineering.

Reflecting his various interests, John is a member of the Committee on Titanium and Reactive Metals of the American Foundrymen's Society and of Subcommittee F-1 of Committee B-5, on copper and copperbase alloys, of the American Society for Testing Materials. He is active also in the American Institute of Mining, Metallurgical and Petroleum Engineers, and the American Society for Metals. His contributions to the technical literature total some 35 papers and articles, including a chapter on titanium in the AFS *Cast Metals Handbook*.

With teenagers Jimmy and Shari, and active 7-year-old Randy, John and Patricia, his wife, do not lack for things to do. John is busy completing their newly built home and caring for his lawn and shrubbery. Sometimes he gets a chance to relax by going fishing with his sons or by playing golf.

BATTELLE TECHNICAL REVIEW

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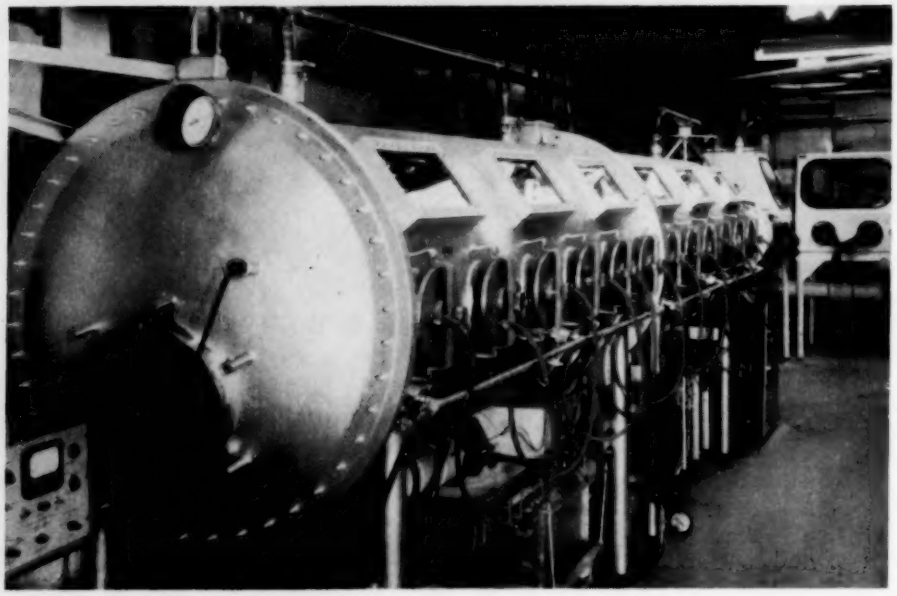


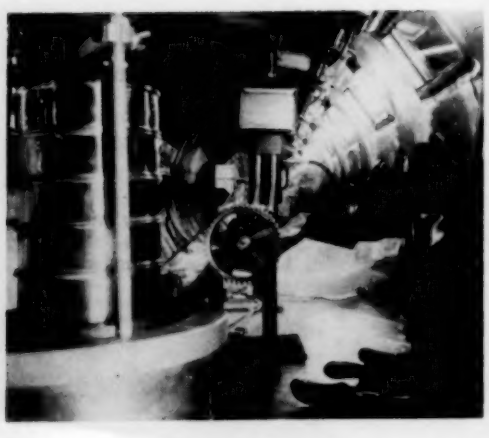
Left above. *General view of Battelle's plutonium laboratory showing (from front to rear) closed boxes for arc melting, welding, fabrication including rolling mill, and (at end) machining.*
Left below. *Another general view of the laboratory. In the foreground is the series of enclosed work areas called the powder-metallurgy train; beyond it is the metallography train.*

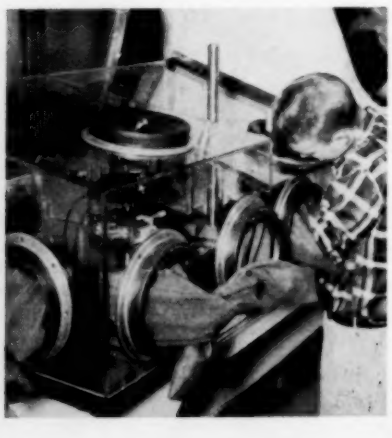
NEW PLUTONIUM LABORATORY

PLUTONIUM, of interest as a fuel in a number of nuclear reactor concepts, is the subject of intensified research activity. A newly-established plutonium laboratory at Battelle has just completed its first study—the evaluation of a pyrometallurgical reprocessing technique for spent fuel elements containing plutonium or its compounds.

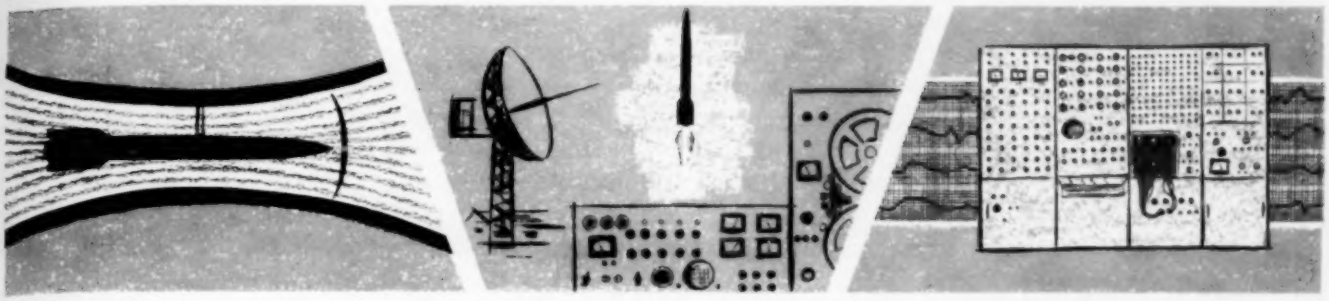
The laboratory is equipped to conduct most types of metallurgical studies. Because of the tendency of plutonium to form a finely-divided, nonadherent oxide, all operations must be handled in closed boxes—most in nonreactive atmospheres. The types of enclosures required are shown in the accompanying photographs of the laboratory.

Equipment is available for the following research activities: melting and casting, welding, rolling, machining, powder metallurgy, and metallography and apparatus for physical metallurgy studies, the determination of properties, and chemical studies. All of these activities are carried out under conditions providing the utmost protection for technologists. Laboratory air, exhausted 15 times an hour through filters, has only one-tenth the radioactivity of outside air when it leaves the building.





Left. *View inside the powder-metallurgy train before it was fully equipped. White polyvinylchloride bag (right center) is used to move specimens.* **Right.** *A portion of the metallography train. Staff member is operating the microscope camera.*



CAN WE PREDICT THE STATE OF THE ART?*

Predicting the "state of the art" is a most important factor in achieving the greatest benefit from research effort. The author discusses some of the problems associated with such prediction.

As a result of the increasing awareness of the value of research on the part of both government and industrial executives, annual research and development expenditures in the United States have grown from $990 million in 1945 to $12.4 billion in 1959. Projections for 1969 run as high as $28 billion. Research and development activities now comprise approximately 2.5 per cent of the Gross National Product and forecasts indicate that in the future, research and development may constitute even a larger part of our total economic efforts. Thus, the efficient utilization of research manpower and dollars has become a matter of importance, not only to research managers and administrators, but to every American.

Despite the rapid strides made by research in the last few decades, research management techniques have changed relatively little. Research is planned, controlled, and evaluated today in approximately the same manner that it has been in the past.

As a consequence, with the importance of research growing continually, American management is vexed by a number of difficult questions. How should a research program be planned? What relationship, if any, should exist between research expenditures and other business cash flows such as total sales or advertising expenditures? How efficiently are current research efforts being conducted? These questions and many others of a similar nature demand exploration in order that research dollars and scientific manpower be allocated in the most efficient manner.

This article examines one of the problems that face those who must plan research efforts: Can we predict "the state of the art" in a field of scientific endeavor? First, the definitional problems related to measuring the "state" and predicting its future development will be explored in some detail. Next, the importance of obtaining reasonable predictions of the state of the art will be discussed. From these analyses a conclusion will be drawn as to whether, at the present time, it is possible to predict the state of the art within well defined limits.

Definitional Problems

The state of the art is one of those terms that has been incorporated into scientific jargon without being explicitly defined. For this reason the expression may be interpreted differently by different groups or individuals. Clearly, a common definition of the concept is necessary.

The state of the art in a field of scientific endeavor may be defined as the accumulated knowledge in the field which is available and has been demonstrated to be useful. This definition is somewhat controversial in that it states the knowledge must have been shown to be useful. In other words, if a concept is involved, it must have been demonstrated that it is indeed a fact rather than merely an hypothesis.

Of course, there are various types and degrees of demonstration. These range from direct observation of physical performance, such as the ability of the specific aircraft to climb at a given rate, or the measurement of

*Henry R. Hamilton prepared this summary of *A Feasibility Study of Techniques for Measuring and Predicting the State of the Art* by Fred L. Bagby, Donald L. Farrar, Robert F. Badertscher, George W. James, and Howard C. Cross conducted at Battelle for the Plans and Programs Office, Air Research and Development Command, U. S. Air Force.

the hardness of a metal, to the judgment on the part of qualified individuals that a factor has been demonstrated. There are also many phenomena whose properties have not been observed directly. For instance, the properties of an airfoil may have been tested in a wind tunnel. To some, the results of tests like this may constitute a satisfactory degree of demonstration; others may want to see the airfoil used on a prototype aircraft before making a judgment; still another group may await the operational performance data from an ordinary production aircraft. Therefore, a controversy exists as to whether many factors have actually received satisfactory demonstration. This is a particularly difficult problem since the definition of the state of the art, which is itself controversial, contains a term that also needs clarification.

The definiton also states that knowledge must be known to be incorporated into the state of the art. This may appear to be a rather innocuous requirement, but it implies that the state of the art may vary with different groups whose knowledge varies. By this definition the state of the art can be increased by dissemination of information in addition to technical advances themselves. In a similar fashion, the state of the art may not be advanced for the great majority of scientific personnel by a technical discovery unless it receives adequate dissemination.

Thus it has been shown that the definitional problems make it difficult to pinpoint the state of the established art at any given time. Any definitions advanced to overcome these problems will be arbitrary to some extent. Nevertheless, the value of establishing a common set of definitions to place the "art" in the same perspective to all scientific, technical, and management personnel should outweigh the disadvantage of being arbitrary. In any event, it is difficult to imagine how one could accurately predict the future state of the art without a clear conception of what comprises the present "state".

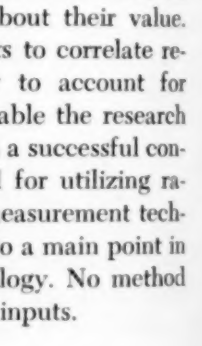
Predicting the State of the Art

Assuming that a suitable, that is, useful, set of definitions were derived to define the existing state of the art, the next logical step would be an attempt to derive an approach to predict what the "state" will be at specific future times. The very nature of research poses the question as to whether this is possible. Would anything actually be research if its outcome could be accurately forecast? Probably not, for research is delving into the unknown. In essence, the path and progress of research must contain an element of uncertainty and for this reason the progress of the state of the art will never be predictable without some degree of error.

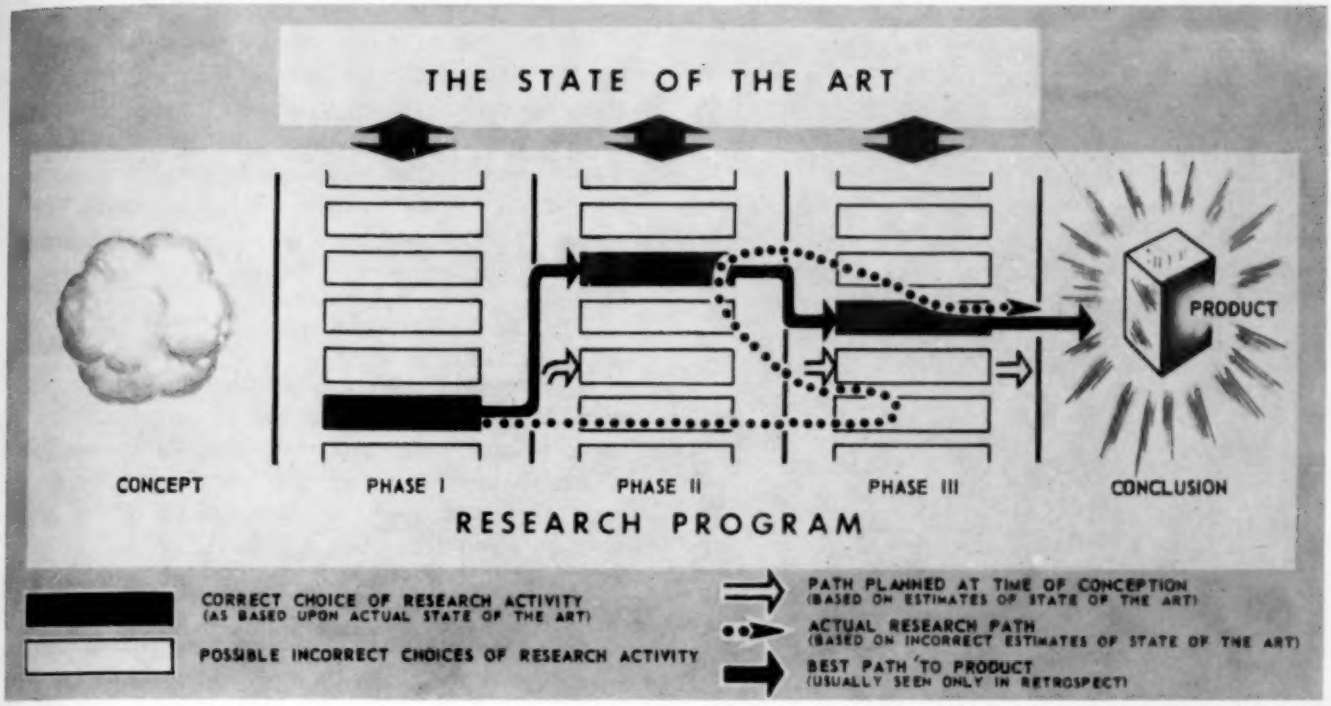
Those who are mathematically inclined, however, will quickly point out that uncertainty can be accounted for through the use of statistics. That is, the expected progress of the "art" might be expressed in terms of the probability of attaining specific research results and some estimate of likely error. Such approaches deserve attention and indeed have received some effort. However, until specific definitions are stated and a large body of data regarding research case histories has been collected and placed within the boundaries of these definitions, it will be impossible to make much progress with statistical techniques.

Some attention is being devoted to attempts to correlate research inputs with research outputs. Again, the definitional problem is encountered and presents a formidable barrier. Research expenditures are not defined consistently by industry. Some firms include quality control, engineering efforts, and other expenditures under the research budget and make no attempt to keep records which segregate them. Indeed, these firms have little in the way of definitions to guide them in differentiating between various types of research, engineering, and developmental work. In addition, measures for relating the cost of inputs to the value of outputs must be defined. Few data are available concerning the cost of research programs and even less is known about their value.

A major problem with the attempts to correlate research inputs with outputs is how to account for breakthroughs in other fields that enable the research program under consideration to reach a successful conclusion. For instance, a new method for utilizing radioactive isotopes may provide the measurement technique that in turn yields the answer to a main point in a research project in the field of biology. No method has been evolved to account for such inputs.



Henry Hamilton, during his first year on the Battelle staff, has participated in research on bank accounting systems, a study of a method of analysis for relating operator variables to system performance, and a search for new uses for established products. A graduate of Lowell Technological Institute with a B.S. degree in textile chemistry and of the Massachusetts Institute of Technology with an M.S. degree in industrial management, the author holds memberships in the Operations Research Society and the American Marketing Association.


THE STATE OF THE ART
PRODUCT
CONCEPT
PHASE I
PHASE II
PHASE III
CONCLUSION
RESEARCH PROGRAM
CORRECT CHOICE OF RESEARCH ACTIVITY (AS BASED UPON ACTUAL STATE OF THE ART)
POSSIBLE INCORRECT CHOICES OF RESEARCH ACTIVITY
PATH PLANNED AT TIME OF CONCEPTION (BASED ON ESTIMATES OF STATE OF THE ART)
ACTUAL RESEARCH PATH (BASED ON INCORRECT ESTIMATES OF STATE OF THE ART)
BEST PATH TO PRODUCT (USUALLY SEEN ONLY IN RETROSPECT)

The importance of accurate predictions of the state of the art. As shown by the indicated paths, the researcher would be able to save much time and effort if he could accurately predict the states of the arts as they relate to his investigation.

Programming the Research Effort

In planning a research and development program, it is desirable to take advantage of the most advanced knowledge and techniques in all the scientific fields which are related to the project being conducted. Furthermore, it is necessary to take into account advances in the state of the art in these fields that might arise during the course of the research effort.

For instance, take the example of a manufacturer who is developing a new engine. The engine design may be predicated in part upon the development of a new bearing which, at first, seemed to be a minor task. If the development of the bearing is not accomplished on time, however, it may throw the whole effort off schedule. It may be necessary to assign more manpower to the bearing problem, perhaps robbing Peter to pay Paul, and thus slowing down the whole research effort. Alternatively, the engine may require redesign to incorporate a more conventional bearing.

If the bearing problem could have been foreseen at the beginning of the project, it would have been possible to plan a more integrated and efficient research program. It is obvious that the problem was the result of misjudging either (or possibly both) the current or future states of the art in bearing technology.

The need for accurate predictions of the state of the art can also be seen in the diagram above. If the research process is visualized as consisting of a number of phases, the course of the research project at each phase is dependent in part upon the results of the previous phase, the current state of the art in related fields, and some concept of what these "states" will be in the future. Misjudging the current or future states of the art or the progress that will be made by the project itself will lead the research program down the wrong path and may be costly in terms of time, research dollars, and manpower.*

In essence, the difficulty of predicting the state of the art mainly influences research costs by introducing problems in programming or scheduling the research effort. If it is impossible for the research programmer or administrator to foresee the path along which the research will proceed, he cannot realistically establish a firm plan to allocate the resources at his disposal. If his estimates of the state of the art contain substantial errors, he will find that it is constantly necessary to alter the direction of his programs and the allocation of his scientific manpower and research funds.

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*For conceptual purposes, the progress of the research program itself can be visualized as an advance in the state of the art and is treated as such in this article. Thus, in the diagram the research program is shown as providing information to the art as well as drawing information from it. By treating the two problems as one in this manner the discussion can be simplified without the loss of any of the concepts involved.

To at least some degree, it must be conceded that change of direction is a part of the research process today. The best that research planners can provide at the present time is an incomplete list of the paths that a research project might follow. Prediction of the exact path or even the relative probabilities of following each of the possible paths is virtually impossible to assess at the outset of research projects. As a result, annoying and often costly changes in direction are commonplace in research and are not necessarily the result of poor research management but of misjudging the state of the art.

Misjudging the state of the art can be costly in two ways. First, if scientific progress is underestimated, the research effort may yield a product which is virtually obsolete at the time it is initially marketed. That is, the product may be quickly replaced by products of competitors who have taken full advantage of the most advanced scientific techniques and information available. On the other hand, overestimating the progress of the state of the art at the beginning of research project, may result in stymieing the research at some point during its course. This may occur because the program is geared to receive an input at a given point and when that point is reached the input is not available.

Another example of the problems created by the difficulty of predicting the state of the art is the perplexing situation in which aircraft manufacturers often find themselves. For example, let us suppose the government requests competitive designs from a number of manufacturers for an aircraft embodying certain minimum performance characteristics. The manufacturer must design an aircraft which incorporates the most advanced electronics, armament, and propulsion systems that will be available *when the aircraft reaches the production stage*. For this reason, it may be necessary to project the state of the art in several fields as many as 3 to 5 years in advance. This is certainly a difficult task.

In addition, the problem embodies aspects of gaming since the aircraft manufacturer realizes that he must not only predict the state of the art, but he must project it in a manner that will seem feasible to the government yet allow a design that is superior to the other aircraft manufacturers that are bidding on the problem. The result is often that the manufacturer is forced to predict that the state of the art will develop at some maximum rate rather than at a rate which could be considered "average" or most likely. This problem is undoubtedly common to many concerns which bid on long-term research and development projects and which must take into account the advances that may be made in impinging technological fields.

The importance of correctly estimating and predicting the state of the art can be seen from the foregoing discussion. However, despite its importance, the state of the art concept itself is rather nebulous. Research planning which depends in part upon assumptions about the state of the art can be made less of a risk if the planner is aware of pitfalls that are associated with the use of the term.

Conclusions

At present there is no valid technique for accurately predicting the state of the art. If progress is to be made toward the goal of predicting the future states of the art in various scientific fields, it will be necessary to adopt a commonly accepted set of definitions with which to define the state of the current art. One definition that is particularly important is the degree and types of demonstration that are necessary to establish that the state of the art has reached a given level. To some extent, these definitions will be arbitrary, but their value would overcome any disadvantages introduced by their arbitrary features. Once a useful set of definitions is derived, it will be necessary to collect a large body of case-history data concerning research problems since a statistical approach to the problem offers the most potential. Any broad study of the research and development process should be on a national basis to permit collection of data under a set of uniform definitions and conditions.

Until a new approach to predicting the state of the art is developed, reorientation and change of direction will be common in research. In some degree this may always be a part of research, for it is doubtful that the progress of the art will ever be predictable without a measure of error. Therefore, at the present time, research managers must keep their programs under constant review in order to quickly adjust their direction to take advantage of new developments and information.

Despite the fact that a foolproof method to predict advances in the state of the art may be impossible to develop, the increasing magnitude of research makes it important that effors be made at least to improve research management in this area. To date, relatively little attention has been devoted to studying the research process. With research now comprising 2.5 per cent of our total economic activity and providing one of the major bases for economic growth, efforts to make the research process more efficient and economical are surely worth while. For this reason, the effort devoted to doing "research on research" should be increased.

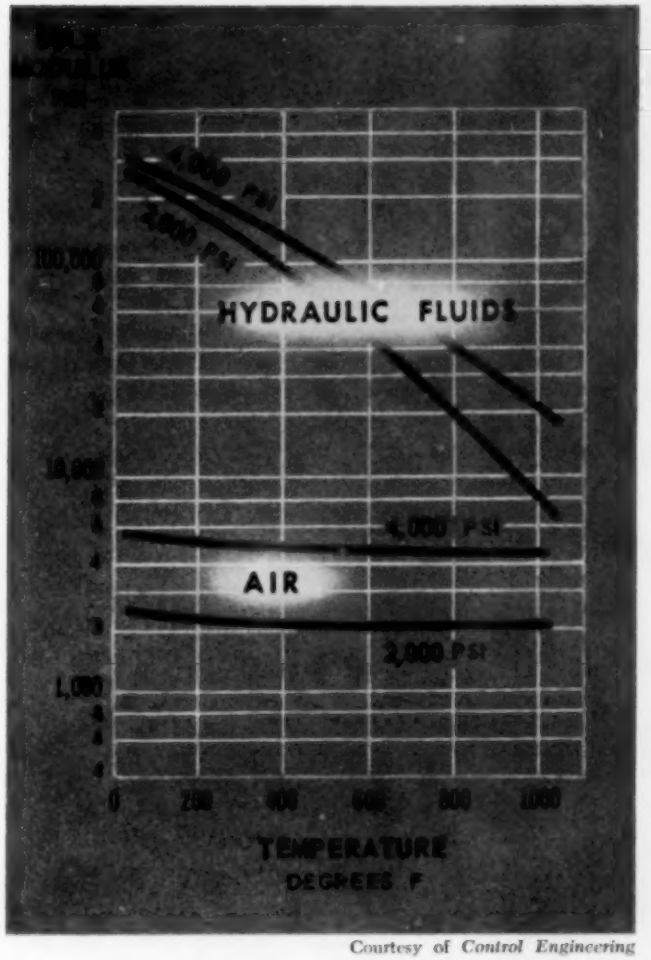
Space Age Ushers in Pneumatic Controls

Temperatures in high-speed flights promise to reach 1000 F and above, making current flight-stabilization systems impractical. The authors discuss pneumatic controls as a possible solution to the problem.

by JOHN K. WETHERBEE *and* JOHN W. BILLHEIMER

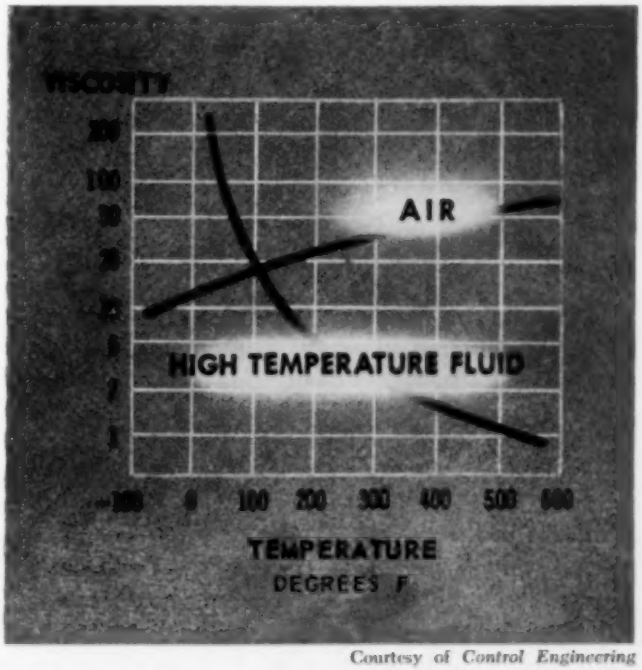
THE FLIGHT-STABILIZATION SYSTEMS currently employed in high-speed aircraft and missiles utilize the dynamic response characteristics of electrohydraulic servomechanisms. In the past, the response characteristics of these servomechanisms have proved to be more than adequate for the tasks assigned them. However, current advancements in flight propulsion techniques have introduced an element which threatens to impair the operational response of all existing flight-stabilization systems. Specifically, this element is the excessive heat encountered both in atmospheric entry and in high-speed flights within the limits of the atmosphere itself.

While it is not unreasonable to expect that the power systems of future aircraft and missiles will have to withstand temperatures of approximately 1000 F as a matter of course, hydraulic fluids now in use are incapable of reliable operation at temperatures exceeding 275 F. Beyond this temperature, such vital fluid properties as lubricity, viscosity, and bulk modulus decline rapidly, often changing by a factor of 20,000 before the 1000 F operating temperature is attained. Although certain organic fluids have been developed which are capable of operating at 700 F, they suffer the same disastrous decline in properties beyond this temperature. Moreover, the storage and handling difficulties inherent in these high-temperature hydraulic



Courtesy of *Control Engineering*

1. *The effect of increasing temperature upon the bulk modulus of various fluids.*



Courtesy of *Control Engineering*

2. *The effect of increasing temperature upon the viscosity characteristics of air and high-temperature fluids.*

fluids tend to limit their application in practical devices.

Nor is the hydraulic element of an electrohydraulic servomechanism the only element whose performance suffers in high-temperature environments. The dielectric strength and resistivity of electrical insulating materials are also subject to high-temperature deterioration. Moreover, currently available electromagnetic control components are relatively useless at high temperatures because of the loss of magnetic properties in these components when such temperatures are reached.

In view of the high-temperature failure of existing electrohydraulic control mechanisms, the realization of a control system which does not limit the performance of advanced vehicles would appear to hinge either on the improvement of existing control mechanisms or on the development of nonelectrohydraulic controls. While much work is being done on the development of improved hydraulic fluids, their high-temperature deterioration is making it increasingly evident that the high-speed flight-control systems of the future will rely primarily upon nonhydraulic devices. Foremost among such devices is the pneumatic control mechanism.

At present, the high compressibility of pneumatic fluids has relegated the use of pneumatic control mechanisms to low-performance applications in which reliability and maintenance considerations are more important than response speed. Examples of such applications are to be found in process control regulators, windshield wipers, and air-conditioning systems.

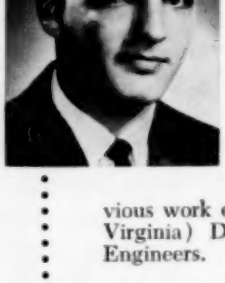
Indeed, the marked inferiority of pneumatic systems to hydraulic systems at low pressures and temperatures wholly explains this relegation of pneumatic devices to low-performance tasks. There is, however, no need to operate pneumatic systems exclusively at low pressures. Rather, it would seem that the working pressure of a pneumatic system should be tailored to fit the purpose of the system. Thus, if the compressibility of a low-pressure gas gives rise to objectionable response characteristics, as it does in the case of flight-stabilization systems, it is only necessary to raise the working pressure of the gas, thereby decreasing the compressibility and improving response characteristics.

While the designer of future flight-stabilization systems has had some degree of latitude in the choice of the pressure at which his working fluid will operate, he is considerably more limited in the choice of a working temperature. As has been noted, this choice is taken out of his jurisdiction by the high temperatures incident with high-speed atmospheric flights. In fact, if high-pressure operation makes possible the use of pneumatic control mechanisms in future flight-stabilization systems, the existence of high-temperature environments may well necessitate their use.

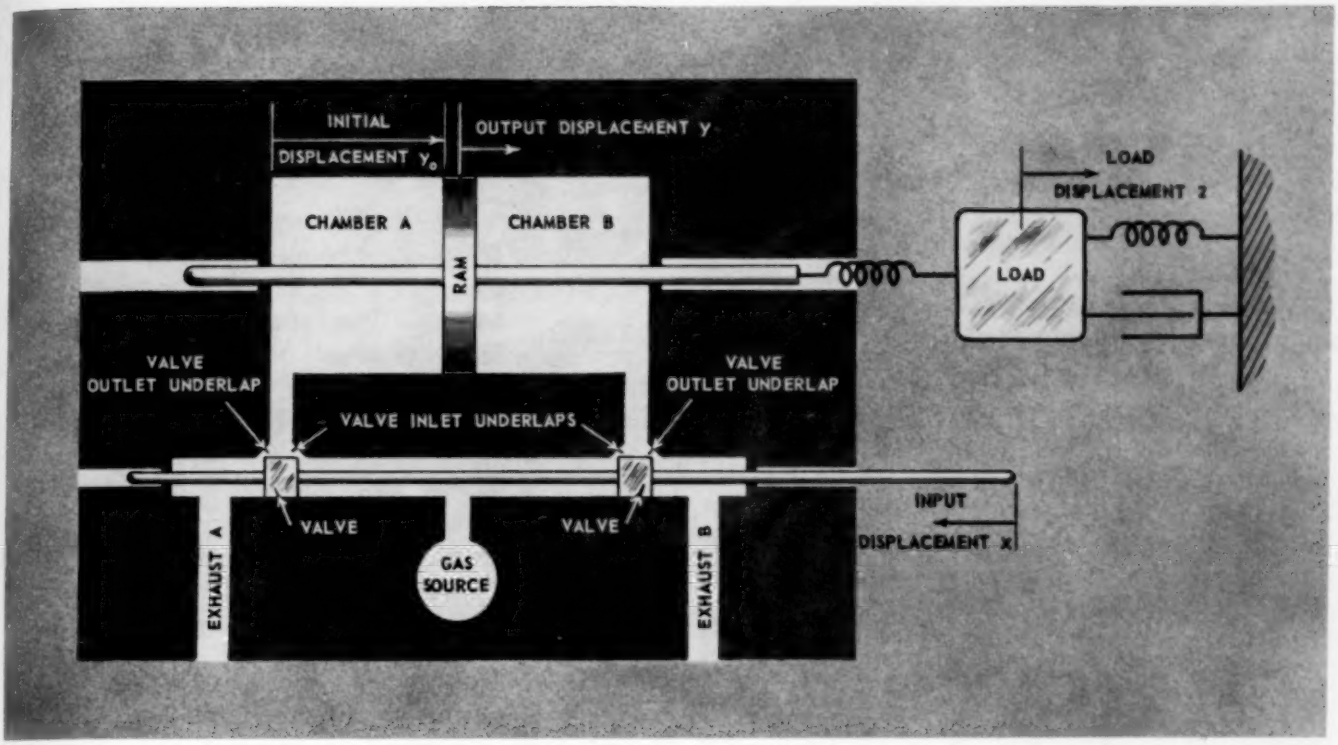
Characteristics of High-Temperature Fluids

The probable necessity of using pneumatic controls in high-temperature environments is perhaps best illustrated by a comparison of the high-temperature characteristics of hydraulic and pneumatic fluids. Whereas, at low pressures and temperatures, the lubricity, viscosity, and bulk modulus of the worst hydraulic system are far superior to those of the best pneumatic system, at high pressures and temperatures the reverse is very nearly true. While each of the above characteristics drops rapidly with increasing temperature in a hydraulic system, the characteristics of a pneumatic system remain essentially constant through-

Since joining the Battelle staff, John Wetherbee has participated in and guided an extensive list of systems engineering studies. Included have been several surveys of the state of the art in guidance in navigation systems; the design and construction of a special-purpose psychological testing apparatus; the development of computer equipment and techniques; and the analysis of air-battle situations by modeling and simulation techniques. He has been responsible also for the systems analysis, servomechanism design, reference system design, and supervision of the digital-director portions of the Naval Radio Research Station radiotelescope-system at Sugar Grove, West Virginia. Earlier, at Link Aviation, Inc., he was responsible for design and production engineering of systems for the B-47 and F-89 aircraft simulators.



John Billheimer is currently associated with the Battelle staff through the cooperative education plan of the University of Detroit. His plans call for completion of studies there for a B.S. degree in electrical engineering in June, 1961. At the Institute he has participated in analog-computer studies of reactor control systems, free piston engines, and hot-gas servomechanisms. He has had previous work experience with the Huntington (West Virginia) District of the U. S. Army Corps of Engineers.



3. *Schematic of a pneumatic actuator or ram attached to a load. Such an actuator might be operated by high-temperature gases.*

out the entire working temperature range. In fact, certain of these critical properties in gases actually improve slightly with increasing temperature. At high temperatures, for example, the viscosity of air, which determines the pressure drop through orifices and greatly affects leakage, increases until it is far superior to that of high-temperature hydraulic fluids. A graphic comparison of the viscosity of air with that of hydraulic fluids is shown in Figure 2. Futhermore, the undesirably low lubricity of air, which determines its ability to resist galling and seizure, is at least on a par with that of hydraulic fluids in high-temperature environments. A similar comparison may be drawn in the case of the bulk modulus, which determines fluid compressibility and consequently serves as an indication of servomechanism stiffness and response time. That is, if existing hydraulic fluids were capable of operating at 1000 F, their compressibility would be roughly equivalent to that of high-pressure gases operating at the same temperature. The truth of this statement is shown graphically in Figure 1.

In addition to its thermal stability over any practical operating range, high-pressure gas has several other distinct advantages as a working fluid in high-temperature flight-stabilization systems. The availability of air as a power medium can hardly be questioned. Moreover, in contrast with most high-temperature hydraulic fluids, it is nontoxic and poses few handling and storage problems. Furthermore, the low density of gas lends itself to relatively easy filtration. Finally, the possibility of utilizing available rocket exhaust gases to operate hot-gas servomechanisms should not be overlooked. Such operation would be ideal for jet vane control and other similar low-inertia applications.

To date, the prime source of dissatisfaction with pneumatic controls has centered on the fact that the compressibility of the working fluid has been so high as to render rapid precision positioning of a high intertia load virtually impossible. As had been noted, however, the compressibility of the working medium is significantly lowered by high-pressure operation. Moreover, the positioning stiffness and response time of pneumatic actuators may also be improved by overdesigning the systems, although such techniques take their toll in reliability and over-all weight. Another, less serious disadvantage involving the use of pneumatic controls is the leakage problem, which necessitates constant care in the installation and maintenance of hoses and fittings.

Computer Study of a Pneumatic Actuator

In an effort to evaluate the relative advantages and disadvantages of pneumatic control systems and deter-

mine whether there are any essentially thermodynamic limitations on such systems at elevated temperatures, an analysis of a basic pneumatic actuator was recently undertaken at Battelle. This analysis took the form of an analog computer simulation of the actuator itself. Specifically, the system studied consisted of a four-way valve controlling gas flow to a pneumatic ram which, in turn, was spring-coupled to a load mass. This load mass was spring- and damper-coupled to a force reference. Figure 3 is a schematic drawing of the system simulated by the analog computer.

The simulated valve-ram-load system was studied by operating the analog computer in successive runs during which such parameters as source temperature and pressure were varied. The effects of these varied parameters on the system as a whole were then recorded as continuous plots of critical quantities. During such studies, the system was excited both by sinusoidal inputs of various frequencies and by graduated step input signals.

Samples of the data obtained by applying graduated step input signals to the system are shown in Figures 4A, 4B, and 4C. This particular set of curves shows graphically the effect of source pressure on system response. It may be seen that an increase in source pressure not only caused a marked increase in gain, but also brought about an increase in damping and speed of response. Moreover, as pressure increased, the ringing frequency of the response tended to rise rapidly above the natural frequency of the load, indicating a greater control of the load at higher pressures. Finally, it should be noted that each family of step-function responses gives an indication of the linearity of the valve-ram-load system. Since equal increments of inputs were applied, it may be seen that the system response was reasonably linear up to an input displacement of 0.02 inch, at which point the valve underlaps were completely closed.

Step-function responses such as those just discussed supplied a good indication of the effect of parameter variations upon the system under observation. Utilizing these responses, together with the steady-state responses of the system to sinusoidal inputs of various frequencies, it was possible to chart the response of the pneumatic actuator over a wide range of pressure and temperature variations. In so doing, it was found that the response characteristics of the actuator not only increased with pressure, but also, to a lesser degree, with temperature. This proved true even at temperatures far above those expected in actual flight environments. These results, coupled with an analysis of a linearized model of the system, led to the conclusion that no essentially thermodynamic limitations existed to hinder the performance of pneumatic control systems operating at the elevated temperatures of high-speed flights.

Hot-Gas Servomechanisms

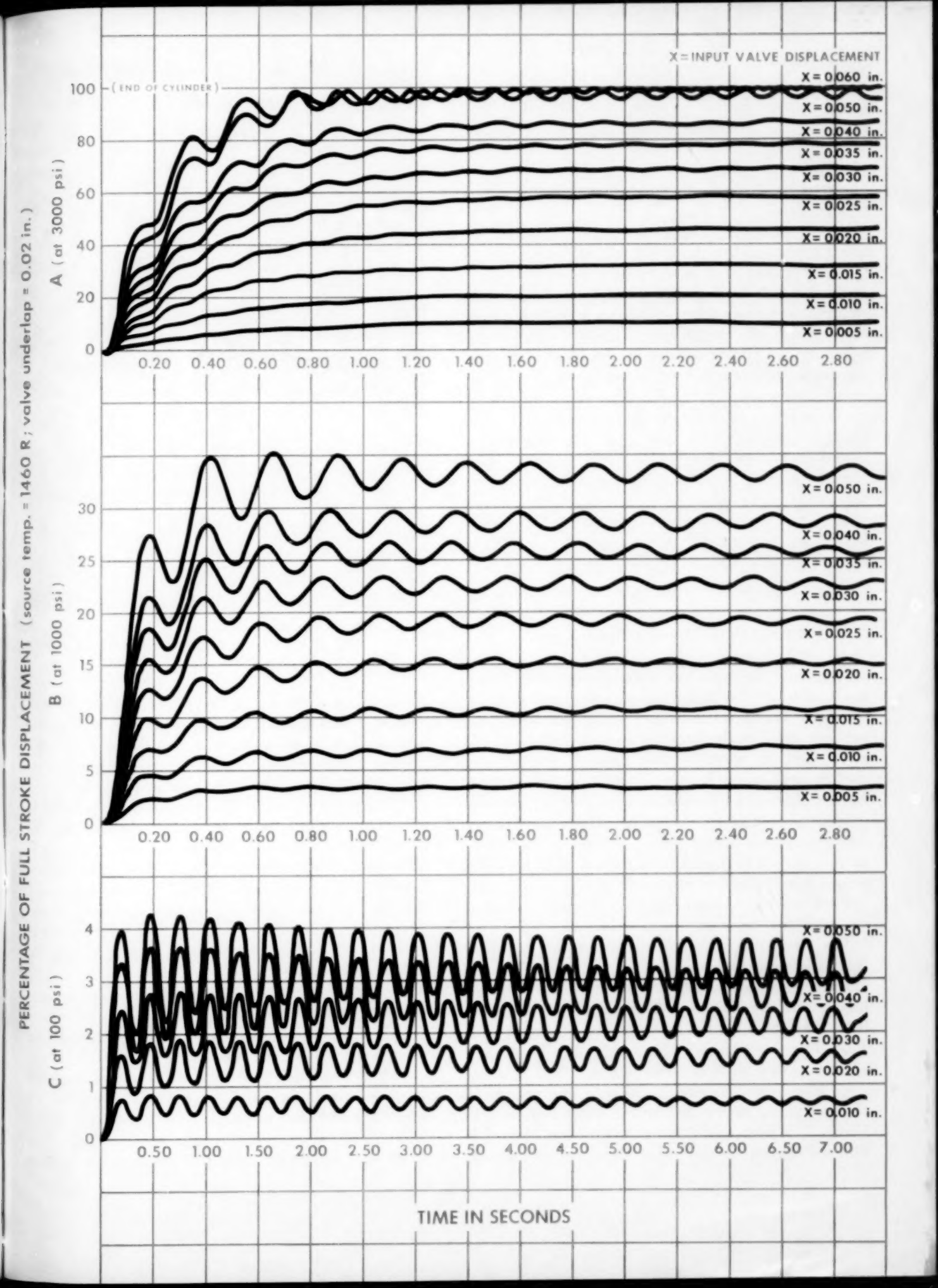
Foremost among the pneumatic control mechanisms considered for use in future high-temperature flight-stabilization systems is the hot-gas servomechanism. Proven stabilization systems utilizing this type of pneumatic control to actuate aerodynamic control surfaces have successfully guided certain operational missiles since 1958. Hence, the flight-tested capabilities of the hot-gas servomechanism would seem to indicate that it will find wide application in aircraft and missiles designed specifically for high-temperature environments.

While the plans of operational hot-gas servo systems are understandably proprietary, the basic principles of all such systems are similar to those of the pneumatic ram simulated in the studies described earlier in this article and depicted in Figure 3. Basically, all such systems are powered by a gas source maintained at a fairly constant pressure. As has been noted, for use in high-performance devices, this source pressure should be kept as high as possible. Gas flow from the source is directed by a servo valve assembly whose positioning is usually determined by an electonic amplifier and torque motor. The valve assembly itself may be either "open center" or "closed center", depending on whether the variable orifice nozzles are constantly open, or open only when the servo is to be moved. The valve-controlled gas flow is used to drive an actuator such as the ram of Figure 3. This actuator, in turn, drives the pay load of the system, which could conceivably be the control surfaces of a flight-stabilization system. The final element in the hot-gas servomechanism consists of a feedback system from the load to the electronic input amplifier.

The recent successful operation of hot-gas servomechanisms in high-temperature environments has been made possible only through the development of advanced hardware designs and techniques. The maintenance of material and performance tolerances at high temperatures is a problem which has long plagued designers of both pneumatic and hydraulic control systems. A few of the hardware problems faced by

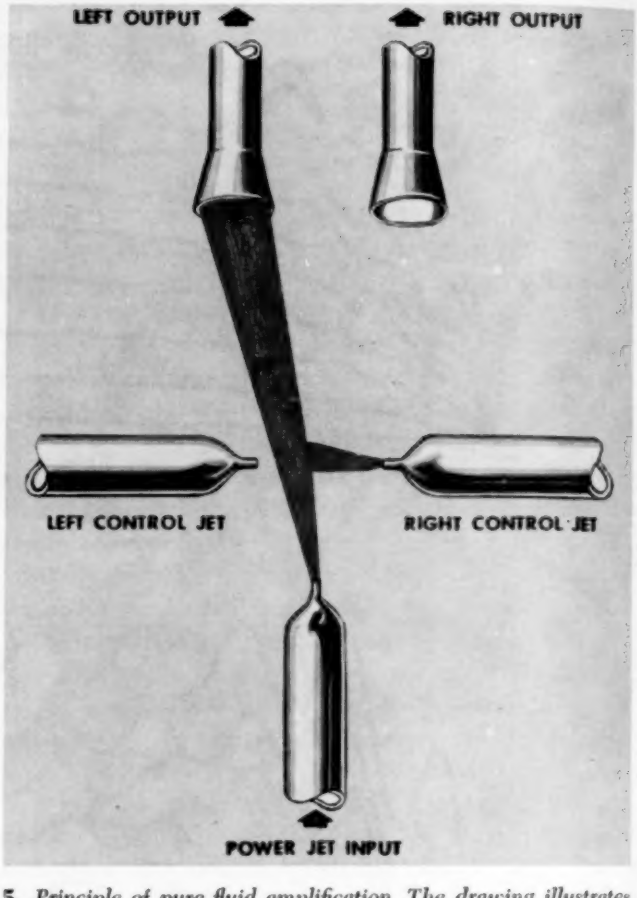
4. *These graphs jointly show the effects of increasing pressure upon power-piston dynamic performance as determined by analog computer. As may be noted, varied pressures give different responses. The graphs also show the nonlinear performance of the piston in the transient rise portion of the response (approximately the left half of the graphs).* →

PERCENTAGE OF FULL STROKE DISPLACEMENT (source temp. = 1460 R; valve underlap = 0.02 in.)


X = INPUT VALVE DISPLACEMENT
X = 0.060 in.
X = 0.050 in.
X = 0.040 in.
X = 0.035 in.
X = 0.030 in.
X = 0.025 in.
X = 0.020 in.
X = 0.015 in.
X = 0.010 in.
X = 0.005 in.
(END OF CYLINDER)
100
80
60
40
20
0
A (at 3000 psi)
0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.20 2.40 2.60 2.80
30
25
20
15
10
5
0
B (at 1000 psi)
4
3
2
1
0
C (at 100 psi)
0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 6.00 6.50 7.00
TIME IN SECONDS
PERCENTAGE OF FULL STROKE DISPLACEMENT (source temp. = 1460 R ; valve underlap = 0.02 in.)

these designers have been the severe high-temperature strength decreases common in most metals, the dimensional changes caused by creep and thermal expansion, and the tendencies toward galling and seizure brought on by the lack of high-temperature lubricants. Moreover, the solution of these problems has been hindered by the lack of high-temperature wear and friction data.

Recent hardware innovations, however, have enabled control-system designers to overcome some of these difficulties. For example, new superalloys such as the Inconels have proved to have excellent tensile strengths at temperatures well above 1000 F. Furthermore, the use of materials having similar coefficients of expansion has largely negated the problem of thermal expansion. Another method maintaining closely toleranced dimensions at high temperatures consists in the application of such thermally stable metals as molybdenum in valves and other critically-dimensioned components. Finally, the development of solid film and graphite lubricants capable of high-temperature performance has eased the seizure problem somewhat. These and other recent hardware developments have been instrumental in bringing the operational hot-gas servomechanism off the drawing board and into the realm of the realizable.



5. *Principle of pure fluid amplification. The drawing illustrates how the main stream is deflected by control jets.*

Problems of Control Components

In spite of the rapid hardware advancements being made in the field of high-temperature control systems, one basic hardware problem remains unsolved. This problem involves the high-temperature failure of the electromagnetic devices being applied as input and control mechanisms in most existing control systems. Not even the most advanced insulating techniques have proved capable of guananteeing reliable electromagnetic operation at elevated temperatures for more than limited periods of time. Dissatisfaction with this high-temperature failure of electronic control components has led servomechanism engineers to search for nonelectric signal input and control devices.

The search for such nonelectric devices may well cause the hot-gas servomechanism to be joined by yet another pneumatic control element in the field of high-temperature controls. This element is the pure fluid amplifier. Recently developed by Diamond Ordnance Fuze Laboratories, the pure fluid amplifier consists solely of a block of metal in which fluid passageways have been strategically placed. The placement of these passageways, sketched in simplified form in Figure 5, is such that a low-power stream of fluid is directed against the side of a high-power stream. If the low-power stream is directed in such a manner that it deflects rather than disrupts the high-power stream, it is wholly capable of controlling this latter stream. Such control of a high-power level by a low-power level is no more than basic amplification.

Though the principle of the pure fluid amplifier is relatively simple, sophistication of this basic device by such artifices as feedback paths has been made possible not only amplification but also analog and digital computation, normal mathematical operations, memory devices, and the regulation of time intervals. Moreover, the inherent simplicity of the pure fluid amplifier, evident in its complete lack of moving parts, greatly enhances its reliability and ruggedness.

The prime limitation of a system containing a pure-fluid amplifier controlling high-pressure gas streams is that which plagues practically all high-performance pneumatic devices. Specifically, this limitation is the speed of response. The response speed of such an amplifier compares with the response speed of an electronic amplifier in roughly the same ratio as the speed of sound compares with the speed of light. The exact effect of this relatively slow response speed upon

high-performance requirements such as those encountered in flight-stabilization systems has not yet been determined. Though the response speed of a pneumatic amplifier may leave something to be desired, there is certainly no question as to the capability of this device to withstand temperature extremes.

In view of this ability of a pure fluid amplifier to operate at high temperatures, it is entirely possible that the high-temperature flight-stabilization systems of the future will not consist solely of hot-gas servomechanisms, but rather of hot-gas servomechanisms controlled by pneumatic amplifiers. In addition to insuring high-temperature performance, such a use of pneumatic elements to control pneumatic elements would also tend to reduce tranduction problems to a minimum.

Conclusion

As has been noted, the comparatively recent development of pneumatic controls has been brought on by the advent of high-temperature environments in the high-speed flights of modern aircraft and missiles. Whereas, existing hydraulic control systems are incapable of operating at the high temperatures encountered in these flights, pneumatic control systems remain stable throughout the entire anticipated thermal range. But thermal stability alone does not warrant the application of pneumatic controls in high-temperature flight-stabilization systems. Recent research has shown not only that no essentially thermodynamic limitations exist to hinder the performance of high-temperature pneumatic controls, but also that high-performance characteristics may be approached in such controls by means of high-pressure operation. This latter knowledge has helped to dispel the reigning belief that the pneumatic control is exclusively a low-performance device. This belief, fostered by the low-pressure operation of existing pneumatic controls and the prevalent use of nozzle-flapper arrangements rather than positive displacement devices such as the pneumatic ram, had for a long time threatened to exclude the pneumatic control from consideration in the design of future high-performance flight-stabilization systems. In addition to showing the theoretical possibility of high-performance pneumatic controls, recent research has produced the hardware necessary to bring these controls out of the realm of the theoretical. In so doing, it has paved the way for the development of the hot-gas servomechanism and, to a lesser extent, the pneumatic amplifier. Futhermore, in so doing, it has made it entirely possible that the air power of the future will be guided by the air power of pneumatic controls.

"The nature of scientific activity is such that the participant in it must be endeavoring to change the status quo. Every new bit of data, every new theory or insight, invalidates to some extent what was known or understood before. Authority is transient, laws are mutable, facts are temporary."

Harold Gershinowitz, president,
Shell Development Company

NOTES from BATTELLE

* OXYGEN-HYDROGEN GENERATOR

An experimental electrolytic gas cell generating an oxygen-hydrogen mixture is a promising fuel source for explosive metal-forming operations and high-temperature welding and cutting torches. The generator, reports Battelle's Dr. John McCallum, who is responsible for development work, consists of a number of flat nickel-plated steel electrodes placed 0.060 inch apart in a plastic or insulated-metal container holding a weak caustic solution. Current is run into the two outside electrodes with the intermediate ones functioning as bi-polar electrodes. Voltage between the electrodes averages two volts. Volume of gas generated can be increased by increasing the number of electrodes.

According to Dr. McCallum, an oxy-hydrogen mixture of approximately 8 to 1 by weight produces the highest flame temperature, fastest detonation, and greatest increase in pressure when ignited. Estimated cost of producing the gas is 10 to 30 cents per 100 cubic feet, depending on electric power costs.

When exploded, the gas mixture creates pressure 10 times greater than the starting pressure, which is limited only by the strength of the container. For example, a 1500-psi mixture on a 2000-sqin. working surface would produce a peak explosive force of 15,000 tons when ignited. Possible applications include forming large sheet parts of the type used in the aircraft and missile industry.

Using gas for explosive forming operations may provide some advantages over conventional methods. When solid or liquid explosives are used, Dr. McCallum explains, pressures of millions of pounds per square inch form the metal within a few microseconds. Shock waves are reflected and reinforce the next wave, sometimes doubling the impact and causing the workpiece to crack.

In contrast, gas explosions produce pressures up to hundreds of thousands of pounds per square inch lasting several milliseconds and have a different shock pattern. With solid explosives, the shock wave goes to a high level almost instantaneously, remains there for a few microseconds, then drops abruptly. The shock wave of a gas explosion rises to a peak within several milliseconds, then tapers off gradually.

As to the safety of the device, Dr. McCallum points out that the autoignition temperature of the gas mixture is about 1100 F. Also, since the gas is generated only as needed, shipping and storing problems are eliminated.

Used in welding and cutting torches, the burning gases can produce temperatures above 3600 F—hot enough to cut and weld steels, aluminum, and nickel; melt platinum; and fuse alumina. Flame temperature can be controlled by varying the amount of moisture in the gases. Trace amounts of caustic in the gas mixture create a yellow flame, making it visible and thus easier to control.

* U. S. NUCLEAR-FUEL RESEARCH

In the early stages of nuclear development in the United States the object of research on fuels was to find materials that would do the job, regardless of cost. "Today, fuel technology has matured to a point where the best fuel materials are known and their problems are appreciated", stated Battelle's Russell W. Dayton before the Third Inter-American Symposium on the Peaceful Application of Nuclear Energy, which met in Rio de Janeiro last month. "Research on fuel materials for power reactors is now concentrated on solving these problems, for these few final material." Such studies are now dominated by the fact that nuclear power is not yet economically competitive with power from conventional fuels, the physicist pointed out, and current fuel research is directed primarily at decreasing fuel-cycle cost.

In the United States, according to Dr. Dayton, most research effort is concerned with reactors burning uranium -235, with some conversion to plutonium. The difficult fuel-processing problems in the thorium-uranium-233 cycle and in the uranium-plutonium cycle, when the fuel materials are recycled a number of times, are being studied on only a small scale.

The problems of reactor costs have been closely studied in the U. S., the physicist declared, and it was found that all items of nuclear power costs are presently higher than their counterparts in coal-fired plants. Among the items boosting nuclear costs are about 0.8 mills per kwhr extra for insurance and operating costs,

and 1.7 to 4.3 mills per kwhr additional for fixed charges. The greatest promise for cost reduction lies in cutting fuel-cycle costs, since nuclear fuel is inherently cheaper than coal. Nuclear power will become competitive with fuel-cycle costs of 1 to 2.5 mills per kwhr.

Currently, studies of nonmetallic fuels—the oxides and carbides of thorium, uranium, and plutonium, and dispersions of these compounds in graphite—dominate research in the U. S. Studies on metallic fuels, which are subject to fission-gas swelling, are directed primarily at determining the conditions under which swelling is not excessive for various metallic fuels, and at improved basic understanding of the swelling problem.

* NIOBIUM DEVELOPMENTS

Growing interest in niobium is to be noted in research relating to both its applications and production. Recently, two significant papers were presented by Battelle technologists—one before the American Nuclear Society's annual meeting in Chicago on "Niobium -20 Weight Per Cent Uranium—High Temperature Metallic Fuel of the Future"; the other, on a new process for producing niobium, at the First International Congress of Chemical Engineering in Mexico City.

John A. DeMastry, Frederick R. Shober, and Ronald F. Dickerson reported in their paper that a niobium alloy containing 20 weight per cent uranium, under study for the U. S. Atomic Energy Commission, has shown excellent tensile strength and hardness at temperatures in the 1600 F range. By contrast, present-day metallic fuels swell and are otherwise unserviceable above 1200 F.

The alloy's prospects for use as a reactor fuel are based upon far more than its high-temperature strength. Battelle research has shown that it has high thermal conductivity—a valuable asset in compact reactors. In addition to retaining fission gases, which are the source of considerable difficulty in operating reactors, the alloy has also demonstrated good corrosion resistance. Moreover, Battelle metallurgists report the niobium alloy can be prepared with little or no difficulty by a consumable-electrode arc-melting technique, and it can be readily fabricated by standard techniques.

The marked advantage of the niobium alloy at high temperatures suggests strongly that this alloy will be used as the fuel for future compact and gas-cooled reactors, where higher operating temperatures will be necessary. Reactors of this type are likely to find use in portable electrical power generators, space-craft propulsion systems, and in ship propulsion systems, where a long-life core and corrosion resistance are prime considerations.

A new process for the production of niobium was described by Dr. Joseph H. Oxley. The Battelle fluidized-bed, vapor-deposition process—well adapted to continuous production—is an entirely new concept in the reduction of niobium pentachloride developed for Nova Beaucage Mines, Limited. Present day chemical and electrolytic processes for producing niobium must be carried out on a batch basis "It is now known," Dr. Oxley said, "that many metals can be deposited in a fluidized bed of seed particles; and, from both a chemical and a metallurgical viewpoint, the hydrogen reduction of niobium pentachloride appears to be particularly adaptable to a fluidized-bed reduction process."

In the process developed at Battelle, hydrogen is used to reduce niobium pentachloride. The volatile niobium pentachloride is fed into a reactor chamber containing a fluidized bed of seed niobium. Subsequent reduction by the hydrogen fluidizing gas at 1500 F produces metallic niobium which is deposited on the seed particles. Seed for the fluidized bed is replenished by grinding a portion of the end product and recycling it into the reactor.

The quality of niobium produced by the fluidized-bed process is "as least as good as the premium-quality niobium presently on the market," according to Dr. Oxley. The new process is capable of producing niobium with less than 500 parts per million of impurities—well within the requirements for niobium used in nuclear reactor fuel elements.

Much of the Battelle report, written by Dr. Oxley in conjunction with Dr. George H. Kesler and Dr. I. E. Campbell, is concerned directly with the operation of the laboratory-scale processing equipment. The report, however, does contain data on rates of production, conversions to metal, and spectrographic and hardness studies of the niobium produced.

* "Microcracked chromium", a term applied to a chromium plate with a microscopic system of criss-crossing cracks, promises better protection against corrosion for electroplated parts. This relatively new development, when deposited over copper and bright nickel, has been credited with a phenomenal improvement in corrosion performance.

A new procedure for depositing chromium with a similar microcracked structure has been identified in

the laboratory according to W. H. Safranek and R. W. Hardy. The procedure, which calls for adding small concentrations of selenic acid to a conventional chromic-acid bath, promises some economical advantages. The technologists are currently interested in a study of the technique.

✱ Battelle staff members recently named to key technical posts include: *C. Malcolm Allen*—chairman, Bearing and Bearing Lubrication Technical Committee, American Society of Lubrication Engineers; *Maynard M. Baldwin*—member, Advisory Committee, Joint Committee on Leather, American Leather Chemists Association and the American Society for Testing Materials; *Russell S. Drum*—member, Research Committee, American Society of Personnel Administration; *Frederick W. Fink*—co-chairman, Marine Symposium (March 13-17, 1961), National Association of Corrosion Engineers; *Paul D. Frost*—member, Armor Committee, Combat and Tactical Division, American Ordnance Association; *John D. Hummell*—member, Power Test Code Committee on Instruments and Apparatus (D-19), American Society of Mechanical Engineers; *J. Harry Jackson*—chairman, Committee 2 on the Review of Metallic Materials of Department of Defense Materials Research and Development, Materials Advisory Board, National Academy of Sciences—National Research Council *and* member, General Committee, Materials Advisory Board, NAS - NRC; *Robert M. Kell*—membership secretary, Committee D-14 on Adhesives, ASTM; *Ward F. Simmons*—member, Administrative Committee on Papers and Publications, ASTM.

✱ The Ohio State University has accepted a gift from Battelle for establishment of a chair to be known as the Battelle Professor of Metallurgy. The purpose of the chair is to enhance and enrich the scientific foundations of instruction and research in the field of metallurgical engineering. Plans call for the professorship, which is to continue for at least five years, to be filled by annual visiting professors. The university has also accepted a Battelle gift of $9000 for equipment for the Graduate Student Laboratory of the University's new Chemical Engineering Building.

✱ Recently appointed: *Sherwood L. Fawcett*, Manager of Battelle's Physics Department. He will direct the research efforts of more than 300 scientists, engineers, and technicians in nuclear and solid-state physics and reactor technology, and will guide the activities of the Battelle Nuclear Research Center.

Writings by STAFF Members

The Further Development and Evaluation of Aural Reading Devices for the Blind. John S. Abma, Lois L. Huffman, and Lawrence J. Mason. PB 144 748; Summary Report, June 30, 1959, pp. 83 (LC mi $4.80, ph $13.80)

Experience in using five prototype aural reading devices indicated the desirability of a number of mechanical and electronic modifications. Changes were made and these alterations resulted in a reliable instrument that produces the letter code much more clearly than did the first models. Evaluation activities included the investigation of various training techniques.

The BMI-16 Recirculating Gas Loop Installed at the ETR. Joseph V. Baum and Gerald A. Francis. U. S. Atomic Energy Commission, BMI-1429, March 18, 1960, pp. 44. (OTS $1.50)

A development program was conducted to provide an inpile loop facility for use in evaluating gas-cooled-reactor fuel subassemblies. The program included the design, construction, and installation of a recirculating gas loop which is located in a 6 by 6-in. facility in the aluminum reflector of the ETR. The loop system was designed to recirculate the primary nitrogen coolant at flow rates up to 0.9 lb per sec and pressures up to 200 psia. It will accept fuel subassemblies up to 36 in. in length and 2.26 in. in diameter with specimen.

Procedures for Electroplating Coatings on Refractory Metals. John G. Beach and John A. Gurklis. *DMIC Memo*, October 9, 1959, pp. 28. (PB 161 185; OTS $0.50).

Brings together a partial selection of procedures that have been employed to electroplate various metals onto the refractory metals, in an attempt to answer the question of how to produce sound, adherent electroplates on the refractory metals. Refractory metals covered are: vanadium, columbium, tantalum, tungsten, titanium, and molybdenum.

Action of Graphite as a Lubricant. W. Bollmann and J. Spreadborough. *Nature*, v. 186, April 2, 1960, pp. 29-30.

Electron-microsopic studies indicate that a hitherto unconsidered mechanism might be important in explaining the lubricating properties of graphite. Instead of the sliding action of graphite layers, micrographs showed a rolling up of sheets of graphite in regions thin enough to be obeserved by transmission.

Procedures for the Metallographic Preparation of Beryllium, Titanium, and Refractory Metals. R. D. Buchheit and G. A. Wheeler. *DMIC Memo No. 37*, October 26, 1959, pp. 38. (PB 161 187; OTS $0.50)

Provides basic information for the metallographic preparation of beryllium, chromium, columbium, molybdenum, platinum, palladium, ruthenium, rhodium, iridium, osmium, rhenium, tantalum, titanium, tungsten, and vanadium.

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High-Temperature-Alloy Cutting Program. J. E. Clifford, D. E. Semones, and J. McCallum. PB 144 650; *AMC TR-59-7-617;* AD 210 979; January 18, 1959, pp. 153. (LC mi $7.50, ph $24.30)

New methods for cutting high-temperature alloys included chemical machining, chemical cutting by high-velocity jets, abrasives slurries, ultrasonics, electroarc and electrospark machining, explosive cutting and electrolytic machining. Multiple cutoff by electrolytic machining was selected for development. A survey made of industrial methods for billet cutoff permitted economic comparisons of new with existing methods and pinpointed important specifications.

A Second Example of a Rabbit Red Blood Cell Antigen Resulting From the Interaction of Two Genes. Carl Cohen. *Journal of Immunology*, v. 84, no. 5, May, 1960, pp. 501-506.

Two new isoantibodies for rabbit blood group antigens were isolated. The antigens detected, called J and K, are controlled by the genes in the *Hg* system. Antigen J occurs as the direct product of the gene Hg^{DJK} and also occurs as an "interaction antigen" in the heterozygote Hg^{A}/Hg^{FK}. Antigen K occurs as result of the action of the gene Hg^{DJK} or of the gene Hg^{FK}. A revised nomenclature is proposed to include these new antigens.

Component Replacement Liability. David Debeau, George James, and William Drozda. *Management Science*, v. 6, no. 3, April, 1960, pp. 295-302.

Management of the sponsoring firm had planned to make a policy decision based on differences between averages of overlapping distributions. After the influence of the probability distributions was evaluated and explained, management reversed its intended policy decision.

A Method of Mounting Minute Particulate Samples of Opaque Ore Minerals for Quantitative Microscopic Analysis. Lee Dillinger and Charles B. Sclar. *Economic Geology*, v. 55, no. 1, pt. 1, January-February, 1960, pp. 187-191.

A method of mounting fine particulate samples of opaque ore minerals as small as 5 mg for quantitative microscopic analysis is described. The method was specifically developed for the preparation of minute samples composed of fine particles ranging in size from 100-5 microns. The method might also be applicable in the preparation of polished thin sections of minute amounts of fine particulate ore-mineral samples.

Materials-Property-Design Criteria for Metals. VIII. The Creep Behavior of Selected Materials in the Range Up to 1% Net Creep Strain and 1000 Hours. R. J. Favor, W. P. Achbach, and H. J. Grover. U. S. Air Force, Wright Air Development Center, *WADC Technical Report* 55-150, September, 1959, pp. 23. (OTS $0.75)

The objectives of this study were to compile and to evaluate creep strain versus time data on airframe structural materials. The range of interest, as recommended by the Elevated Temperature Task Group of the ANC-5 Panel, includes creep strain up to 1% and time up to 1000 hours. Only two reference sources dealt with creep of airframe structural materials within the conditions of strain and time imposed. Although both of these sources have considerably extended the knowledge of creep behavior in the early stages of creep, it appears that neither has encompassed adequately the regions of interest specified.

Annotated Bibliography on the Use of Organolithium Compounds in Organic Synthesis. Florence Emert, Robert W. Gibson, Jr., and Ralph L. Darby. Supplement No. 7. Unpaged. January 1, 1960. Lithium Corporation of American, New York. (QZD412.65 L71a Ref.)

A supplement containing abstracts or papers which were published or became available during the year 1959. The main emphasis of the bibliography is the use of alkyland aryllithium compounds in Grignard-type reactions. However, the scope of the bibliography has been broadened to include abstracts of papers dealing with the use of lithium metal as a reducing agent in ammonia and low molecular weight amines, reflecting current interest in this type reaction. Other applications of lithium metal and lithium compounds in organic synthesis are also included; for example, their use as catalysts or initiators in various polymerization procedures.

Development of Thorium-Uranium-Base Fuel Alloys. Martin S. Farkas, Arthur A. Bauer, and Ronald F. Dickerson. U. S. Atomic Energy Commisison, BMI-1428, March 18, 1960, pp. 28. (OTS $1.00)

Thorium-uranium alloys were studied with the aim of developing alloys with improved irradiation behavior by control of microstructure. The effect of thorium purity, melting technique, hot and cold working, and heat treatment on microstructure was investigated. The most significant microstructural differences occurred as a result of casting technique. The arc-melted alloys exhibited the most nearly ideal structure, that of a homogeneous dispersion of small-diameter uranium particles in a throium matrix. It was found that small additions of Mo or Nb were effective in stabilizing the gamma uranium phase, while zirconium was an effective hardener at temperatures up to 600 C.

Heat Treatment of High-Strength Steels for Airframe Applications. R. J. Fiorentino, D. B. Roach, and A. M. Hall. PB 151 076; *DMIC Report* 119, November 27, 1959, pp. 111. (OTS $2.50)

Describes illustrative heat treaments, uses, fabrication, atmospheres, protective coatings, cleaning, and descaling of low-alloy hardenable engineering steels, hot-work die steels, martensitic stainless steels, martensitic precipitation-hardenable stainless steels, semi-austenitic precipitation-hardenable stainless steels, and cold-rolled austenitic stainless steels.

Drilling High-Strength Steels Heat Treated to 330 to 560 Brinell Hardness. A. F. Gerds, Carl T. Olofson, and F. W. Boulger. PB 161 181; *DMIC Memo* 31; AD 225 672, August 24, 1959, pp. 17. (OTS $0.50)

Successful drilling of hardened steels requires adequate power, rigidity, and appropriate drills. Drilling speeds and feeds range from 7 to 40 feet per minute, and 0.0005 to 0.005 inch per revolution, respectively. Feeds must be positive. Idling in the hole without cutting work hardens the steel below the drill point, making further drilling vitually impossible. Rigid setups between work and drill, and the use of short, heavy-duty drills are emphasized. These factors increase drill life and hole accuracy, and frequently allow the use of less expensive high-speed steel drills.

Preparative Aids in the Quantitative Evaluation of Electron-Microscope Stereo Pictures. H. Grothe, E. Knobling, and G. Schimmel. (*In German.*) Präparative Hilfsmittel zur quantitative Auswertung elektronenmikroskopischer Stereoaufnahmen. *Fourth Internatonal Conference on Electron Microscopy*, Berlin, September, 1958, v. 1, pp. 146-149. Springer-Verlag, Berlin.

In spite of the increased resolving power obtained by the electron microscope, differences in depth are often unrecognizable, causing important errors in length measurements. This paper describes a simple method for the measurement of stereo pictures, preventing difficulties due to insufficient knowledge of the titlting angle and magnification or to distortion of the photographic paper. Polystyrene globules on the object to be examined were used to calibrate the stereometer. Since the globules appear only as white spots on negative, carbon replicas were used. These proved very suitable for stereometrical measurement and depth evaluation, especially in the case of fiber studies.

Formation and Initial Growth of Single-Asperity Solid-State Bonds. F. C. Holden, J. B. Melehan, H. R. Ogden, and R. I. Jaffee. *Journal of Applied Physics*, v. 31, April, 1960, pp. 670-673.

A gold needle point in contact with a gold flat has been used to study the formation and initial growth of single-asperity solid-state bonds. In the absence of external pressure, the growth of the bonded area can be express analytically by a diffusion-controlled rate equation. Values for the coefficient of self-diffusion determined from these experiments are in reasonable agreement with those given in the recent literature.

Heat Capacity of Beryllium. J. W. Holladay. PB 161 186; *DMIC Memo* 36, October 19, 1959, pp. 11. (OTS $0.50)

Heat capacity as a function of temperature, and effect of impurities on the heat capacity are discussed.

Refractory Materials. I. Technology and Low-Temperature Behavior. Robert I. Jaffee and Daniel J. Maykuth. *Aero/Space Engineering*, v. 19, June 1960, pp. 22-27 + 1 page.

Deals with the general technology of refractory materials—that is, their availability, methods of extraction consolidation to primary shapes, and fabrication to secondary shapes and end items. The stability of the refractory materials (thermodynamic, chemical stability in service environments, and thermal stability after use) is discussed in general terms. Last, the mechanical behavior at low temperatures, particularly the low-temperature brittleness problem, is discussed.

Wear Measurements of Combustion Motors by Means of Radioactive Isotopes and With the Help of Spectral Analysis. J. Jaspert and A. Reuter. *MTZ Motortechnische Zietschrift*, v. 21, no. 5, May 1960. (*In German.*) Verschleissmessungen an Verbrennungsmotoren mit radioaktiven Isotopen und mit Hilfe der Spektralanalyse.

Surveys the factors to be considered in the selection of a method to measure wear. By means of radioisotopes the abrasion on small structural elements and even on selected points of such elements may be measured rapidly and rapidly and continuously. Often, conventional analytical methods are of advantage for the examination of larger structural elements or for simultaneous examination of several machine elements in long-duration tests. The selection of the measuring method should therefore be preceded by a careful examination of the requirements of the specific case.

Fabrication of Pure Columbium. W. D. Klopp and Webster Hodge. PB 161 184; *DMIC Memo* 34, AD 226 046, September 11, 1959, pp. 9. (OTS $0.50)

The fabrication of pure columbium is readily carried out cold with conventional tools. Precautions must be taken, when extreme-pressure processes are used, to prevent sticking by the use of very smooth die finishes and proper lubricants. Since the metal is rapidly contaminated by all common gases at elevated temperatures, welding operations must be performed in an atmosphere of helium or purified argon, and annealing operations in a high vacuum. Solid-solution alloys may be handled, in general, like pure columbium.

Plastic Pipe—How Good Is It? H. W. Kuhlmann. *American Gas Association Monthly*, v. 42, no. 6, June 1960, pp. 15 + 3 pages.

Information received from visits made to gas companies, plastic pipe fabricators, and raw material suppliers, and from surveys of trade literature and published papers is presented to answer the following questions requested by the Gas Operations Research Committee of the American Gas Association: Why is or is not plastic pipe being used; what are its advantages over other pipe; what problems have been encountered; and where or how can plastic pipe be improved to meet more fully the requirements of all the gas distribution companies?

The Welding of Wrought Age-Hardenable Nickel Base Alloys for Service at Elevated Temperatures. W. J. Lepowski and R. E. Monroe. *DMIC Memo*, No. 38, November 25, 1959, pp. 21. (PB 161 188) (OTS $0.50)

Summarizes information on welding wrought age-hardenable nickel-base alloys. The fusion and resistance welding of some of the more familiar alloys that comprise the age-hardenable nickel-base materials are covered.

Submerged-Arc Welding HY-80 Steel. W. J. Lewis, G. E. Faulkner, D. C. Martin, and P. J. Rieppel. *Welding Journal*, v. 39, June, 1960, pp. 266s-272s.

A study was made to develop methods for making submerged-arc welds capable of withstanding severe impact loading at low temperatures. Increasing Ni content lowered weld-metal notch toughness, especially at testing temperatures above —40 F, increased Ni appeared to be beneficial. Increasing Mn content also lowered weld-metal notch toughness at testing temperatures above —40 F, but at testing temperatures below —40 F, the notch toughness of the welds was about the same. Increasing Mo content generally lowered weld-metal notch toughness.

Thermal Properties of Six Glasses and Two Graphites. C. F. Lucks, H. M. Deem, and W. D. Wood. *American Ceramic Society Bulletin*, v. 39, June, 1960, pp. 313-319.

Thermal-conductivity, linear-thermal-expansion, specific-heat, and density values are reported for the following materials: white (clear) plate glass, Pyrex No. 774, Solex 2808X, Solex "S", Grades 7087 and GBH graphite, fused silica, and Vycor. The temperature range covered is, in general, from —250 to about 1000 F.

Titanium Fabrication and Reliability Problems in Aircraft. W. Stuart Lyman, C. T. Olofson, and A. M. Federico. PB 161 183 *DMIC Memo* 33, AD 226 589, September 4, 1959, pp. 32. (OTS $0.50)

Briefly reviews the subject in four quick steps: (1) Metallurgical background, (2) Reliability of incoming material, (3) Shop experiences, and (4) Service reliability.

The Determination of Hydrogen in Titanium and Its Alloys; A Critical Review. T. D. McKinley. PB 144 564; *Titanium Metallurgical Lab Memorandum*, September 23, 1957, pp. 25. (LC mi $2.70, ph $4.80)

Theory, operational characteristics, and indicated precision and accuracy of analytical methods based on vacuum extraction, equilibrium pressure, and combustion approaches are reviewed. At the present time, vacuum extraction at 1400 C and the equilibrium pressure method are recommended for determination of hydrogen in titanium and titanium-rich alloys.

Developments in Electrographic Printing. H. R. Miller and E. B. Friedl. *Plating*, v. 47, May, 1960, pp. 502-527.

The electrographic printing method for evaluating porosity and cracking in protective-coating systems on metals is described and discussed. Electrographic printing makes use of a small direct current to transfer ions from the basis metal through discontinuities in the coating to a chemically treated dye-transfer paper. A pressure device is used during passage of the current to hold the material firmly against the treated paper. Color changes locate precisely cracks and pores in the coating.

High-Temperature Irradiation of Metals and Graphite in Flowing Helium. Neil E. Miller, Donald J. Hamman, Ward S. Diethorn, and William H. Goldwaite. U. S. Atomic Energy Commission, BMI-1419, February 23, 1960, pp. 16. (OTS $0.75)

As part of the coolant-core evaluation studies in an early phase of the maritime Gas-Cooled Reactor (MGCR) program, Ni, K-Monel, niobium-1 w/o Zr, and graphite were irradiated in a convective flow of He. A capsule of novel design was used to study the corrosion of the metals at 1500 F and 960 F in a 243-hr BRR experiment. No attack of the Ni and niobium-1 w/o Zr was observed at either temperature. Metallographic examination did show a 1 to 2.5-mil attack of the K-Monel at 1500 F in a torus containing no getter.

Outlook for Fuels as Sources of Energy. D. D .Moore. Paper from *Business Prospects in 1960, Some Factors Relating to the Longer Term Economic Outlook. II. Papers Presented at the Sxith Pitt Conference on Business Prospects, Friday, November 6, 1959*, Bureau of Business Research, University of Pittsburgh, Pennsylvania, pp. 35-53.

Supplies of our fossil fuels are adequate to meet the foreseeable needs during the next 20 years, and to support a good share of the needs for many decades thereafter. Technological means have been developed that assure an abuandance of energy for centuries to come. But to fulfill man's dreams and aspirations in space and time will require technological developments providing energy at a minute fraction of the cost obtainable by use of fossil fuels.

Development of High-Strength Steels by Working of Metastable Austenite. F. R. Morral. PB 161 189; *DMIC Memo* 39, November 30, 1959, pp. 24. (OTS $0.50)

On hot-cold-worked steels, as in steels conventionally heat treated to martensite, there is a trend of rising strength and falling ductility with increasing carbon content. The greater the deformation of the metastable austenite, the better the yield and tensile strength properties. Tensile strengths of 400,000 psi have been obtained with deformations on rolling of the order of 90% reduction in cross section. For the aircraft and missiles

industries, the steels containing 0.30 to 0.40 C seem to be the most suitable.

Milling of High-Strength Steels in the Hradness Range of 330-560 Brinell. C. T. Olofson. *DMIC Memo* 30; August 17, 1959, pp. 40. AD-225 673. (PB 161 180; OTS $0.50)

Carbide tool materials best suited for use include the C-2, C-3, C-6, and C-7 grades. Carbide cutter design utilizes 0- and 15-degree negative rake angles, depending on the hardness of the steel being milled. High-speed-steel cutters appropriate for milling high-strength steels include the molybdenum types of M-3, Type 2, M-10, M-4, and M-7, and the cobalt grade, M-34. Tungsten high-speed steel with 5 per cent cobalt (T-15) seems to give the best tool life, on the basis of limited data.

Metals With Finely Distributed Non-Metallic Additions. R. Palme. (*In German.*) Metalle mit fein verteilten nichmetallischen Zusätzen. *Metall*, v. 14, May, 1960, pp. 421-424.

Additions of oxides can considerably increase strength and hardness and decrease the tendency to recrystallize. In pure metals, a high increase of the creep strength at elevated temperatures is possible. In alloys, the effects of additions are less marked. Additions of finely divided oxides of the base metals give satisfactory results in light metals. Aluminum products with addition of 10 to 14% AlO_3 are well known. Oxide additions to heavy metals or heavy alloys often are detrimental to grain boundary strength; stable carbides or nitrides should be added to correct this. Non-metallic additions to metal are introduced by powder metallurgy methods or by internal oxidation.

Irradiation-Capsule Study of Uranium Monocarbide. Robert B. Price, David Stahl, John H. Stang, and Eugene M. Simons. U. S. Atomic Energy Commission, BMI-1425, March 2, 1960, pp. 38. (OTS $0.75)

Small cylindrical specimens of enriched uranium carbide were irradiated in the MTR as part of a program to evaluate for Atomics International the usefulness of uranium carbide as a high-temperature fuel for stationary power reactors. Detailed thermal and nuclear analyses were made to arrive at an appropriate capsule design on the basis of target specimen centerline temperature (−1500 F), specimen surface temperature (100 F), specimen composition (uranium -5 w/o carbon), and a capsule of 1.125 in. Temperature data from thermocouples inside the capsules indicated that five of the six capsules irradiated had operated at close to the design conditions.

New Developments in Metals-Joining Processes. P. J. Rieppel. *Machine Design*, v. 32, June 9, 1960, pp. 189 + 5 pages. Covers improvements and different processes that have been introduced to general use since 1956. Electroslag, electron-beam, arc-spot, high-frequency, foil-seam, magnetic-force, ultrasonic, friction, and explosive welding methods, and high-temperature brazing and diffusion bonding are discussed in detail.

Release of Fission Products From Fueled Graphite. W. C. Riley, D. N. Sunderman, and B. W. Dunnington. *Nuclear Metallurgy*, v. 6, 1959, pp. 87-94.

Irradiation experiments were performed in fueled graphite to study fission-product release at high temperatures. Very large fission-gas release was observed in elements irradiated or annealed at temperatures in the range of 1000 to 1700 F. However, certain modifications to the fueled graphite, such as increasing the fuel particle size and the use of either external coatings or coatings on fuel particles, were found to result in large reductions in fission-product release. The effect on release rate of fuel-element temperature, time at temperature, irradiation rate and level is given for various types of fueled graphite.

Physical and Mechanical Properties of Nine Commercial Precipitation-Hardenable Stainless Steels. D. A. Roberts, D. B. Roach, and A. M. Hall. Battelle Memorial Institute, Defense Metals Information Center, DMIC Report 112, May 1, 1959, pp. 83. PB 151 068 (OTS $2.25)

Presents the physical and mechanical properties of commercial precipitation-hardenable stainless steels. The steels covered include the martensitic types (stainless W and 17-4 PH), the semiaustenitic types (A-286, 17-10 P, and HNM). Room- and elevated-temperature tensile and compressive properties, stress-rupture and creep properties, and impact, shear, bearing and fatigue properties are reported. The effects of variations in heat treatment on these properties are also presented.

Vibrations of Ferroelectric Transducer Elements Loaded by Masses and Acoustic Radiation. F. Rosenthal and V. D. Mikuteit. *IRE Transactions on Ultrasonics Engineering*, v. UE-7, no. 1, February, 1960, pp. 12-15. (TK1 In6.6u Vis.)

The motion, stress distribution, and electrical impedance are calculated for idealized three-layer sonic transducers, consisting of a piezoelectric element loaded at either end by a mass which may be distributed or lumped, and loaded further by resistive plane-wave acoustic radiation.

The Influence of Sheet Thickness on Tensile Properties of Metal Sheet. Alfred Rudnick and Robert L. Carlson. PB 161 156; DMIC Memo 5, January 23, 1959, pp. 19. (OTS $0.50)

A review of the literature on the effect of specimen geometry indicates that the percentage total elongation increases as some power of the product of specimen thickness and width. Thus, it is possible to combine the effects of thickness and width into a single parameter—cross-sectional area. No significant influence of thickness on strength apparently exists. Consideration of the correlation between laboratory measurements and actual useful ductility leads to the conclusion that uniform elongation may be a more significant index of ductility than is the more commonly used total elongation.

Preparation and Reactions of Phosphinic Acid Esters. Manfred Sander. (*In German.*) Herstellung und Reaktionen von Phosphonigund Phosphinig säureestern. *Chemische Berichte*, v. 93, no. 5, 1960, pp. 1220-1230.

Phosphonic acid esters can be prepared by partial substitution of phosphoric acid-dialkylester-chlorides or of trialkyl prosphites by means of Grignard compounds. Similarly, phosphinic acid esters can be obtained from phosphoric acid-alkyl (or aryl)-ester-dichlorides and 2 mol of RMgCl. In addition to reactions already known, their smooth saponification into phosphonic acid semiesters or secondary phosphine oxides, their reaction with PCl_3 into mono- and dichlorophosphines, and their reduction into primary and secondary phosphines are described.

Electron-Microscope Investigations of the Hydration of Cement. G. Schimmel. (*In German.*) Elektronenmikroskopische Untersuchungen über die Hydratation von Zement. *Physikalicshe Blätter*, v. 16, no. 4, 19560, pp. 214-220.

Hydration proceeds in two stages. Initially leaf-like hexogonal $Ca(OH)_2$ is formed; after 48 hrs. a fibrous structure appears. In the second stage, acicular tobermorite crystals ($CaO.SiO_2.H_2O$) occur. By the seventh day a cubic phase becomes visible. After 14 days, the formation of needle-like crystals decreases; some parts of the structure show no definite crystal form. After 28 days, no needle-like crystals are visible; the structure consists of hexagonal and cubic phases.

Low-Temperature Recovery of Ductility in a Hydrogen-Embrittled Alpha/Beta Titanium Alloy. F. R. Schwartzberg, D. N. Williams, and R. I. Jaffee. *Institute of Metals, Journal*, v. 88, pt. 8, April, 1960, pp. 352-356.

Tensile tests performed at various temperatures, strain rates, and hydrogen levels allowed an activation energy to be calculated for the embrittlement process in hydrogen-containing Ti-2% Fe-2% Cr-2% Mo alloy. The activation energy based on the recovery of ductility at low temperatures is similar to that for diffusion of hydrogen in unalloyed β-titanium. Thus, it was concluded that the recovery of ductility is a rate-controlled process related to the diffusion of hydrogen in the β phase of the two-phase alloy.

Development of Die Lubricants for Forging and Extruding Ferrous and Nonferrous Materials. H. L. Shaw, F. W. Boulger, and C. H. Lorig. PB 140 915; October 31, 1955, pp. 246. (LC mi $11.10 ph $39.30)

Tests were made on 2014 aluminum alloy, AZ80A magnesium alloy, unalloyed titanium, and Type 403 stainless steel. Procedures were developed for improving metal flow in forging operations, particularly in working Al and Mg. Commercial

experiments in which an improved method of lubrication was tried, suggested that improvements in die design might be necessary to take full advantage of improved lubricants.

A Study of the Influence of Lubricant Properties on the Performance of Aircraft Gas Turbine Engine Rolling-Contact Bearings. L. B. Sibley, J. C. Bell, and others. *Final Technical Report* for April 22, 1957- September 21, 1958, on Contract Af 33 (616)-5109, October, 1958, pp. 75. WADC Technical Report 58-565; AD-204 218. (PB 145 032; LC mi $4.50, ph $12.30)

The development of improved lubricants for aircraft gas turbine engine bearings depends, to a large extent, on how well the influence of lubricant properties on bearing performance can be predicted. A literature and field survey and some special experiments and analyses on this problem have been conducted. A possible approach for further research in this field is suggested.

Studies Relating to Hydrogen in Dingot Uranium. Max J. Trzecjak and Manley W. Mallett. U. S. Atomic Energy Commission, BMI 1225, September 20, 1957, pp. 32 (TIE $0.65)

Solubilities and effects of H were determined on magnesium, uranium, and magnesium fluoride slag. The possibility of removing H from U by degassing at elevated temperatures and at low pressures was considered. Calculations were made for the diffusion of H in U rod. Several cases were chosen to illustrate the potentialities of this technique.

Review of Electrical Machining Methods. Max J. Trzeciak and Francis W. Boulger. AD-225 298; PB 161 178; DMIC Memo 28, August 5, 1959, pp. 14. (OTS $0.50)

Three common noncenventional electrical machining methods are the spark-discharge, electrolytic grinding and miling, and arc-discharge methods. Sparikng occurs between the tool and workpiece electrodes, which are separated by a dielectric fluid, when the voltage between these electrodes is increased until it exceeds the resistance of the dielectric. Electrolytic erosion may be considered as an accelerated etching and lapping operation such as that used in preparing metallographic specimens. The characteristic of the arc-discharge method is that it thermally erodes the workpiece.

Preparation and Analysis of Titanium-Hydrogen Standard Samples. Max J. Trzeciak. Report on Contract AF 18 (600) 1375, PB 161 160; DMIC Memo 9, February 9, 1959, pp. 14. (OTS $0.50)

Titanium-hydrogen standard samples were prepared individually from degassed titanium rods. The hydrogen was added to the degassed titanium sample in a modified Sieverts apparatus. Battelle analyses of 20 standards were in good agreement with the amounts of hydrogen added. Analytical results of 24 samples by two outside laboratories were in excellent agreement with the amounts of hydrogen added.

The Corrosion Protective Characteristics of Decorative Chromium Plate. W. H. Safranek, H. R. Miller, and C. L. Faust. *Plating*, v. 47, May, 1960, pp. 513-519.

From a study of chromium plate quality as related to plating conditions, ranges were established for depositing crackfree and nearly porefree chromium, which inhibited corrosion in the nickel plate on which the chromium was deposited. The crack-free and porefree chromium also inhibited basis-metal corrosion in copper and nickel-plated zinc die castings.

Department of Defense Titanium Sheet-Rolling Program: Status Report No. 2. C. R. Simcoe. TML Report No. 46B; PB 121 630; September 25, 1957, 52 pp. (OTS $1.50)

Studies were made: (1) to determine the effect of forging and heat treatment variables on the mechanical properties of the Ti-7Al-3Mo alloy; (2) to determine the effect of sponge quality on mechanical properties of 7Al-3Mo alloys; and (3) to evaluate the tensile, creep-rupture, and stability properties of the alloys Ti-6Al-3Nb, Ti-6Al-3Mo-2Ge, and Ti-6Al-3Mo-4Ge.

A Visual Study of the Corrosion of Defected Zircaloy-2-Clad Fuel Specimens by Hot Water. E. F. Stephan, P. D. Miller, and F. W. Fink. U. S. Atomic Energy Commission, BMI-1387, October 19, 1959, pp. 30. (OTS $1.00)

The failure of defected Zircaloy-2-clad uranium and uranium-2 w/o Zr fuel specimens in high-purity high-pressure water at 200 to 345 C was observed in a windowed autoclave. Time-lapse color motion pictures were taken to provide a record of the progressive changes ending in the complete disintegration of the core material in the specimens.

Protection of Rubber Vulcanizates Against the Effect of Ozone. J. Szurrat. (*In German.*) Ozonschutz von Kautschuk-vulkanisaten. *Gummi und Asbest - Plastische Massen*, v. 13, no. 1, January 1960, pp. 16-20; no. 2, February, 1960, pp. 74-78.

An effective agent for protection against ozone must be introduced during the mixing process, must penetrate the surface of the vulcanizate, and must build up a protective film to interfere with the infiltration of ozone. The agent must react chemically with the absorbed ozone on the surface of the vulcanizate without negatively affecting the double bonds of the polymer molecule. The protection is carried out by use of waxes, by the coating with ozone-resistant polymers, by an increased addition of aging control agents, by the development of saturated and ozone-resistant polymers, and by the development of specific agents to protect against ozone.

The Impact of Technology on Future Products. B. D. Thomas. *Industrial Design, January*, 1960, pp. 63-65.

The over-all effects of current technological change on product design will be those resulting from the availability of improved materials. Products will be smaller, more compact, and more reliable. They will be more ingenious. Mechanical devices will be lighter and smaller, and they will do more things in easier ways. With better materials to work with, designers will be able to handle safety factors with greater assurance. The economic and social status of the design engineer—already of great significance to our way of life—will become even more important and significant.

Effect of Gamma Radiation on Leathers and Pickled Calfskin. Victor G. Vely, Nicholas D. Gallagher, and Maynard B. Neher. *American Leather Chemists Association, Journal*, v. 55, April, 1960, pp. 202-219.

Shrinkage temperature, breaking strength, and elongation properties of irradiated and nonirradiated control samples selected by a matched-pair scheme were compared. A moderate level of irradiation (10^7 reps) resulted in significant decreases in these physical properties of both leather and pickled calfskin. A pronounced reduction in these properties indicative of very severe damage occurred at the highest level of irradiation used (10^8 reps). Vegetable-tanned leather showed a greater decrease in shrink temperature but less decrease in breaking strength than chrome-tanned and retained leathers. Pickled calfskin was adversely affected by 10^7 reps irradiation as indicated by significant decreases in shrink temperature and breaking strength.

Duplicate Printing Plates. J. Homer Winkler. *Electrotypers and Stereotypers Magazine*, v. 45, December, 1959, pp. 3 + 10 pages.

As with original printing surfaces ,duplicate plates possess important and unique characteristics for letterpress printing production. Each kind of plate has its advantages, its natural market, its fringe applications. Frequently, pattern plates are used in making duplicate plates. These pattern plates contain one or more units and have been especially finished to be suitable for molding operations.

A Study of the Effluents From Back-Yard Incinerators. J. E. Yocom, G. M. Hein, and H. W. Nelson. *Annual Paper No. 56-2*, Buffalo, New York Meeting, May 20-24, 1956, Air Pollution Control Association, 4400 Fifth Avenue, Pittsburgh 13, Pennsylvania.

The effluent from a typical back-yard incinerator of 6-cubic-foot capacity burning a "standard" charge was sampled by means of a large-scale freeze-out train and evacuated vessels. Analysis of the collected samples by means of chemical and infrared absorption techniques revealed extremely complex mixtures of organic compounds. Estimates were made of the probable concentrations in the effluent of such materials as lower alcohols, certain unsaturated hydrocarbons, aldehydes, phenols, acids, and ammonia.

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

8620* Applying Methods Engineering and the Planning Team Approach at Frigidaire Division. The planning team, working with other departments, guides the product from the design stage to the final assembly line. ***Robert J. Schmidt.*** *General Motors Engineering Journal*, v. 7, no. 2, Apr.-May-June 1960, p. 19-22.

8621* Phasing Research Into the Marketing Plan. The basis of marketing management is the market investigation and analysis; the next level is the information, and the highest level is the planning. A full collaboration between the staff group and the decision-making executive is necessary. ***Lee Adler.*** *Harvard Business Review*, v. 38, no. 3, May-June 1960, p. 113-122.

8622 Enculturation in Industrial Research. Discusses the adaptation experiences of one hundred new research workers in ten industrial laboratories. ***Robert W. Avery.*** *IRE Transactions on Engineering Management*, v. EM-7, no. 1, Mar. 1960, p. 20-24. (TK1 In6.6em Vis.)

8623 Revitalizing the Engineering Organization. Ten tests are proposed to help engineering managers in analyzing decision-making charts. ***Philip Marvin.*** *Machine Design*, v. 32, May 12, 1960, p. 170-176.

8624 Promotion of Fundamental Research. Discusses the findings of the symposium on basic research recently published by the American Association for the Advancement of Science and their significance, not only for the United States, but for Great Britain as well. *Nature*, v. 185, Mar. 12, 1960, p. 715-717.

8625* Problems of Research Problems. Discusses the difficulty of defining research problems, as well as solving them. The lack of communication between scientists and non-scientists is treated briefly. ***Phil Heiberger.*** *Paint and Varnish Production*, v. 50, no. 6, May 1960, p. 69-70.

8626 Government Organization of Science. The question of organization of a department of science and technology in the federal government is analyzed from different viewpoints and traced back to the first voices about this matter. ***Dael Wolfle.*** *Science*, v. 131, May 13, 1960, p. 1407-1417.

8627 Science and Engineering in American Industry Report on a 1956 Survey. Research and development costs and personnel in manufacturing and other industries, in commercial laboratories and engineering service firms, and in trade associations are cited and discussed. 117 pp. 1959. U. S. Department of Labor Bureau of Labor Statistics, Washington, D. C. (TA157 N21se)

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

8628 Transport and Thermodynamic Properties in a Hypersonic Laminar Boundary Layer. II. Applications. New theoretical results are obtained for stagnation point heat transfer, and these are compared with earlier theoretical results, and with available experimental data. It is found that at both high and low altitudes the authors' results are larger than the theoretical values predicted by Sibulkin and Lees, but smaller than those of Romig, and Fay and Riddell. ***Sinclaire M. Scala and Charles W. Baulknight.*** *ARS Journal*, v. 30, Apr. 1960, p. 329-336.

8629 Thermal Control of the Explorer Satellites. The theoretical studies that were made prior to the launching of these satellites are described, and examples of relationships are presented in graphs. The lower limit of the instrument temperature was 0 C. The upper limit was specified as 65 C. ***Gerhard Heller.*** *ARS Journal*, v. 30, Apr. 1960, p. 344-352.

8630 Minimum Time Flight Paths. A general condition is derived which must be satisfied by an aircraft or space vehicle in order to reach a predetermined point in a minimum time. The

*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

thrust, lift and drag can depend, in an arbitrary manner, on the instantaneous position and velocity coordinates (or Mach number) as well as on the angle of attack between the directions of the thrust and the velocity. ***G. M. Schindler.*** *ARS Journal*, v. 30, Apr. 1960, p. 352-355.

8631 Conical Turbulent Boundary Layer Experiments and a Correlation With Flat Plate Data. Measurements in the turbulent boundary layer of unyawed cones for Mach numbers from 1 to 6 are presented. Temperature profiles, directly determined skin friction, and local heat flux in the turbulent boundary layer of cone models are given. ***W. S. Bradfield.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 82, no. 2, May 1960, p. 94-100.

8632* Heat and Mass Transfer in Aeronautical Engineering. Shows that standard techniques of heat and mass transfer theory can be applied to the corresponding aeronautical problems, particularly those arising in connection with high-speed flight and rocket propulsion. ***D. B. Spalding.*** *Aeronautical Quarterly*, v. 11, pt. 2, May 1960, p. 105-136.

8633* A Theoretical Approach to the Aerodynamically Significant Properties of Roughness From Insects. Deals with the problem theoretically for an aerofoil in two-dimensional, incompressible flow. The application of these investigations, in conjunction with an analysis of the critical conditions for premature transition, leads to estimates of the amount of significant roughness which are in good agreement with flight observation. ***W. S. Coleman.*** *Aeronautical Quarterly*, v. 11, pt. 2, May 1960, p. 171-194.

8634 The State of Airborne Inertial-Guidance. Tips on how to get the most performance with least weight, space, and cost. Why design approach to aircraft navigators is diametrically opposed to missile systems. Gyros used in pitch attitude control are least critical, azimuth most critical. ***Donald Galbraith.*** *Aircraft and Missiles*, v. 3, June 1960, p. 28-32.

8635* Pressure Cabin Analysis. An extension is made to the theory on which most aircraft pressure cabins are designed. In the existing theory the effect of the curvature of the deformed cylinder is neglected. This paper examines the manner in which this effect influences the stress distribution. ***D. S. Houghton and A. S. L. Chan.*** *Aircraft Engineering*, v. 32, May 1960, p. 126-131.

8636 Measurements of Skin Friction of the Compressible Turbulent Boundary Layer on a Cone With Foreign Gas Injection. The relative reduction in skin friction is in accordance with theory—that is, the light gases are most effective when compared on a mass flow basis. There is a marked effect of Mach number on the reduction of average skin friction; this effect is not shown by the available theories. ***Constantine C. Pappas and Arthur F. Okuno.*** *Journal of the Aero/Space Sciences*, v. 27, May 1960, p. 321-333.

8637* The Increase Factor of Added Weight and the Weight Equivalent of Added Drag. Examines how far the flying weight can be increased in order to avoid a decrease in the planned flying performance. An increase factor is introduced, by which the excess weight is multiplied. This factor is derived from the required reinforcement weights and the weights equivalent to the increase in drag; its order of magnitude is discussed and correlated with design requirements. (*In German.*) Der Vergrösserungsfaktor der Zusatzgewichte und das Gewichtsäquivalent der Zusatzwiderstände. ***Heinrich Hertel.*** *Luftfahrttechnik*, v. 6, Apr. 1960, p. 100-104.

8638* Flight in the Thermosphere. II. Materials for Nonmelting Heat Sink Systems. Excellent thermal conductivity and high specific heat are the most important properties of materials for heavy-wall heat sink applications. ***William S. Pellini and William J. Harris, Jr.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 113-115.

8639* Flight in the Thermosphere. III. Materials for Ablation, Sublimation and Transpiration Systems. These absorptive systems have a high effective heat capacity. The sublimation potential of graphite, one of the best materials, may be limited by exothermic oxidation. ***William S. Pellini and William J. Harris, Jr.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 89-92.

8640 The Icing of Delta Wings of Unity Aspect Ratio Having Leading Edge Separation. Tests were made in an icing wind tunnel of two models, and the resulting ice formations are described and illustrated. The significance of scale is discussed, and it is shown that the tests are representative of icing conditions with large droplets and high speeds. ***C. K. Rush.*** *National Research Council of Canada Aeronautical Report, LR-268*, Dec. 1959, 38 pp. (TL501 C16.5L Contin.)

8641 Brief Experiments on a Flapped Aerofoil Having a Cusped Cavity and a Blowing Jet at the Cusp. Experiments show that it is possible to produce a flow regime in which the cavity is occupied by a stable trapped vortex. With the aerofoil immersed in a quasi-two-dimensional finite stream, greater rotation of the resultant force vector was obtained with a flap of this type than with a flap having no cavity. The results indicate that the combination of a blowing jet and a trapped vortex may be used to advantage in enabling an external flow to overcome an adverse pressure gradient. ***A. D. Wood.*** *National Research Council of Canada Aeronautical Report, LR-269*, Dec. 1959, 21 pp. (TL501 C16.5L Contin.)

8642 Wake of a Satellite Traversing the Ionosphere. A study of the structure of the wake behind a charged body moving supersonically through a low-density plasma. For the case of a body whose dimensions are considerably smaller than a Debye length, a solution is obtained which is very similar in structure to the solution obtained by using the linearized fluid dynamics equation. ***S. Rand.*** *Physics of Fluids*, v. 3, no. 2, Mar.-Apr. 1960, p. 265-273.

8643 Space Flight. I. Environment and Celestial Mechanics. Utility of space flight, the solar system, the central force field, the orbit in space, and perturbations are discussed. ***Krafft A. Ehricke.*** v. VI. 513 pp. 1960. D. Von Nostrand Co., Inc., Princeton, N. J. (UG630 M55p)

8644 Tracking and Display of Earth Satellites. In a new method of displaying the predicted paths and real-time positions of artificial earth satellites, cathode-ray tubes are used with two types of map overlays; orthographic projection and Mercator projection. Functions to match these projections are generated electronically. ***Frederick F. Slack and Allen A. Sandberg.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-59-370*, Dec. 1959, 21 pp. (TK7800 Un3.12b Contin.)

8645 Longitudinal Range Control During the Atmospheric Phase of a Manned Satellite Reentry. Two trajectory control techniques are used, one making use of a ground-controlled approach type of procedure and the other using cockpit displays. The results indicate that the trajectory of a re-entering satellite could be guided to a desired destination by utilizing pilot-applied control with terminal range errors of about ± 20 miles. ***Arthur Assadourian and Donald C. Cheatham.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-253*, May 1960, 46 pp. (TL570 Un3t Vis.)

8646 Wind-Tunnel Tests of a Circular Wing With an Annular Nozzle in Proximity to the Ground. Measurements of lift, drag, and pitching moment were obtained at various angles of attack for altitudes from 1 to 50 inches, free-stream dynamic pressures from 0 to 30 pounds per square foot, and nozzle pressure ratios from 1.0 to 2.0. ***Richard K. Greif, Mark W. Kelly, and William H. Tolhurst, Jr.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-317*, May 1960, 37 pp. (TL570 Un3t Vis.)

8647* Concerning the Problem of the Stepped Formation of Airplanes. Misleading Data in Air Navigation. Considers the three margins of error occurring when staggering aeroplanes at different altitude levels; the instrument error, the error in the measurement of static pressure, and the position error. These are related to pressure, the physically correct and only possible unit of measurement. The altimeter is shown to give the least error as regards assigning and sustaining altitude, particularly if calibrated in pressure units. (*In German.*) Zur Frage der Höhenstaffelung von Flugzeugen. Irreführende Begriffe in der Luftfahrzeugführung. ***Heinrich Koppe.*** *Zeitschrift für Flugwissenschaften*, v. 8, Apr. 1960, p. 111-121.

AGRICULTURE

8648 An Electric-Powered Tractor. Describes an experimental tractor powered by electric current generated in fuel

cells. ***Harry K. Ihrig.*** *Agricultural Engineering*, v. 41, Apr. 1960, p. 232 + 2 pages.

8649* The Preservation of Fish With Ionizing Radiation: Bacterial Studies. Irradiation of cod fillets at relatively low levels of gamma irradiation prolongs the bacteriological storage life at 0 C and appears particularly effective against the genera usually associated with the production of offensive odors characteristic of typical spoilage. ***Donald P. MacLean and Camille Welander.*** *Food Technology*, v. 14, May 1960, p. 251-254.

8650* Glycerol Production: A Pilot-Plant Investigation for Continuous Fermentation and Recovery. A pilot plant was built to evaluate the economic potentialities of producing glycerol from sugar by the bisulphite fermentation process. The economic success of the process depends to a large extent upon the price of sugar. Under present conditions it is felt that the process is competitive. ***John F. Harris and George J. Hajny.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 1, Apr. 1960, p. 9-24.

8651* Insecticidal Baits for Control of the Imported Fire Ant, *Solenopsis saevissima richteri*. Peanut butter containing 0.125% Kepone was the most effective bait used in small- and large-plot field experiments. When this bait was applied at the rate of 4 or 6 lb. per acre, 100% of the fire ant colonies were eliminated. The peanut butter bait was injected into soda straws with a grease gun to facilitate application in the field. Other promising Kepone baits were prepared as pellets from equal parts of peanut butter and peanut meal and as polymerized granules of peanut butter. ***Sidney B. Hays and F. S. Arant.*** *Journal of Economic Entomology*, v. 53, no. 2, Apr. 1960, p. 188-191.

8652* Spotted Alfalfa Aphid Resistance in Mature Growth of Alfalfa Varieties. Varieties rated resistant—Lahontan, Moapa, Zia, Bam, and Sirsa No. 9—carried low populations and made excellent growth under conditions of epidemic infestation at high temperatures. Forty-three other varieties, classed intermediate and susceptible, supported heavy aphid populations that caused different degrees of plant injury. A wide range in tolerance was indicated by mortality rates of 2 to more than 90% for plants supporting 300 or more aphids per stem. ***W. L. Howe and G. R. Pesho.*** *Journal of Economic Entomology*, v. 53, no. 2, Apr. 1960, p. 234-238.

8653* Residue Studies of Livestock Sprays Containing Sevin. ***R. H. Roberts, J. B. Jackson, W. E. Westlake, A. J. Ackerman, and H. V. Claborn.*** *Journal of Economic Entomology*, v. 53, no. 2, Apr. 1960, p. 326-327.

8654 Mechanisms of Insect Resistance to the Chlorohydrocarbon Insecticides. Points discussed include differences between susceptible and resistant houseflies as regards penetration and metabolism of the insecticide. ***F. R. Bradbury and H. Standen.*** *Journal of the Science of Food and Agriculture*, v. 2, Feb. 1960, p. 92-100.

8655* High-Amylose Cornstarch—Properties and Prospects. The results of preliminary studies on the oxidation, hydroxyethylation, and carboxymethylation of high-amylose starch and the effects of these modifications on its dispersibility and paste properties are presented. ***F. R. Senti and C. R. Russell.*** *Tappi*, v. 43, Apr. 1960, p. 343-349.

BIOCHEMISTRY AND BIOPHYSICS

8656 Gravity Problems in Manned Space Stations. ***Carl C. Clark and James D. Hardy.*** *Aero-Space Engineering*, v. 19, May 1960, p. 36-39.

8657 Design of an Operational Ecological System. General requirements for a manned scientific low-orbit (150-400 miles) space station are given. ***Eugene B. Konecci and Neal E. Wood.*** *Aero/Space Engineering*, v. 19, May 1960, p. 42 + 3 pages.

8658* Mitotic Activity of Cancerous Cells Suppressed in Human Tissue Culture by Inhibitors of Free-Radical Reactions. Test revealed that propylgallate suppresses the mitotic activity of cancerous Hela cells in man and slows down the growth of the culture. With certain concentrations of propylgallate this effect is selective; the growth of the culture of cells of normal epithelium is not suppressed. This selectivity may be partly due to the variety in the content of natural inhibitors in tumorous and normal tissues. (*In Russian.*) Podavlenie mitoticheskoĭ aktivnosti rakovykh kletok cheloveka v kul'ture tkaneĭ pri vozdeĭstvii ingibitorov svobodno-radikal'nykh reaktsiĭ. ***L. P. Lipchina, O. K. Shiiataia, G. G. Afanas'ev and N. M. Emanuel'.*** *Akademiia Nauk SSSR, Doklady*, v. 131, no. 3, Mar. 1960, p. 667-669 + 1 plate.

8659 Anatomy of the Human Body. ***R. D. Lockhart, G. F. Hamilton, and F. W. Fyfe.*** 697 pp. 1959. J. B. Lippincott Co., Philadelphia. (QM23 L81a)

8660 Annual Research Task Summary. Biological, Medical, Social and Behavioral Sciences and Operations Research. The Annual Research Task Summary for 1959 contains information on research tasks in the U. S. Army Research and Development Program. The tasks reported include those being carried out both in Army laboratories and under contracts. v. I. Unpaged. 1959. Army Research Office, Office of the Chief of Research and Development, Department of the Army, Washington, D. C. (U393 Un3.1a)

8661 Some Considerations of Bioengineering From a Microscopic Viewpoint. Reviews some theoretical considerations of substrate needs in antibiotic production and concludes that a combination of bioengineering knowledge in mixing, and biological knowledge in providing cells which tend to grow less in such tight clumps could result in more rapid and efficient biochemical reactions. ***Richard Donovick.*** *Applied Microbiology*, v. 8, no. 2, Mar. 1960, p. 117-122.

8662* Base Composition of the Ribonucleic Acids of Normal Tissues, Tumors and Tissue Subfractions. ***Saul Kit.*** *Archives of Biochemistry and Biophysics*, v. 88, no. 1, May 1960, p. 1-9.

8663* Biochemistry of Amphibian Oöcytes. I. Method of Isolation and Nucleic Acid Content of Nuclei. A procedure for the mass isolation of frog mature ovarian egg nuclei is described. Chemical analyses of these nuclei indicate they contain approximately 800 times more DNA and roughly 3600 times more RNA than frog liver nuclei. Because of the extraordinary DNA content, the mature ovarian egg nucleus is apparently an exception to the general rule of DNA constancy in nuclei of a species. ***F. J. Finamore, D. J. Thomas, G. T. Crouse, and B. Lloyd.*** *Archives of Biochemistry and Biophysics*, v. 88, no. 1, May 1960, p. 10-16.

8664 New Methods Probe Space Flight Hazards. ***Evert Clark.*** *Aviation Week*, v. 72, May 23, 1960, p. 54 + 3 pages.

8665* Studies on the Nucleotide Arrangement in Deoxyribonucleic Acids. III. Identification of Methyleytidine Derivatives Among the Acid Degradation Products of Rye Germ DNA. IV. Patterns of Nucleotide Sequence in the Deoxyribonucleic Acid of Rye Germ and Its Fractions. ***Herman S. Shapiro and Erwin Chargaff.*** *Biochimica et Biophysica Acta*, v. 39, no. 1, Mar. 25, 1960, p. 62-82.

8666* Synthesis of Macromolecules in Synchronously Dividing Bacteria. The synthesis of deoxyribonucleic acid, ribonucleic acid, protein, and induced β-galactosidase proceeded exponentially and continuously throughout the entire division cycle. ***Fred E. Abbo and Arthur B. Pardee.*** *Biochimica et Biophysica Acta*, v. 39, no. 3, Apr. 22, 1960, p. 478-485.

8667* A Study of the Genetic Material Determining an Enzyme Activity in Pneumococcus. Transformation of the different mutants to maltose utilization by wild-type DNA occurred with different frequencies. Recombination of genetic material of the maltose-negative strains also gave rise to positive cells. Analysis of the recombinations indicated that the regions corresponding to the different markers are linked and arranged in a linear fashion. Some larger regions overlapped several smaller ones indicating that single mutations altered regions in the genetic material of different size. ***Sanford Lacks and Rollin D. Hotchkiss.*** *Biochimica et Biophysica Acta*, v. 39, no. 3, Apr. 22, 1960, p. 508-518.

8668* Studies in Leukemia. XV. The Induction of Leukemia in Swiss Mice With Human Leukemic Brain Ex-

tracts. *Steven O. Schwartz, Wilma Spurrier, Le Roy Yates, and Bill J. Maduros.* *Blood*, v. 15, May 1960, p. 758-760.

8669* Relationships of Immunology to Cancer: A Review. *Chester M. Southam.* *Cancer Research*, v. 20, no. 3, pt. 1, Apr. 1960, p. 271-291.

8670* Studies in Tumor Auto-Immunity. A rise in a serologically reactive serum protein fraction was observed following irradiation or intramuscular injection of whole tumor antigen in adjuvant in twelve of fourteen patients with a wide variety of malignant diseases. Evidence is presented to support the concept that this serologically reactive plasma protein is an antitumor antibody. *J. W. Finney, E. H. Byers, and R. H. Wilson.* *Cancer Research*, v. 20, no. 3, pt. 1, Apr. 1960, p. 351-356.

8671* Mixed Bacterial Toxins in the Treatment of Tumors. III. Effect of Tumor Removal on the Toxicity and Mortality Rates in Mice. Surgical removal of well established, 6-day-old Sarcoma 37 from ICR Swiss mice and treatment 24 hours later with high dosages of bacterial toxins resulted in mortalities, death rates, and weight losses which were equivalent to those of normal mice, but strikingly less than those in mice still bearing the intact Sarcoma 37. *H. Francis Havas, Andrew J. Donnelly, and Stanley I. Levine.* *Cancer Research*, v. 20, no. 3, pt. 1, Apr. 1960, p. 393-396.

8672* Chromosomal Aberrations and Human Diseases. The Klinefelter Syndrome XXY of 46 Chromosomes by Centromeric Fusion of T-T. A man, exhibiting the Klinefelter syndrome showed only 46 chromosomes in spite of the presence of two X and of one Y chromosome. A centrometric fusion of two T-class chromosomes is apparently the cause of this paradox. (*In French.*) Aberrations chromosomiques et maladies humaines. Syndrôme de Klinefelter XXY à 46 chromosomes par fusion centromérique T-T. *Jérôme Lejeune, Raymond Turpin, and Jacques Decourt.* *Comptes Rendus Hebdomadaries des Séances de l'Académie des Sciences*, v. 250, no. 13, Mar. 28, 1960, p. 2468-2470.

8673* Effect of Some Simple Lipids on the Phagocytic Function of the Reticulo-endothelial System. Certain lipids were administered intravenously; olive oil and glycerol trioletate caused stimulation of the function, whereas oleate and ethyl stearate caused inhibition. (*In French.*) Effet de quelques lipides simpels sur la fonction phagocytaire du système réticulo-endothélial. *Angus E. Stuart, et al.* *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 15, Apr. 11, 1960, p. 2779-2781.

8674 Fourth International Conference on Electron Microscopy, Proceedings. Biological and Medical Part. Contains lectures concerning the techniques of electron microscopy in biology, fixation and embedding, cutting methods and microtomes, histochemistry and biochemistry, membranes, cellular morphology, cytoplasm and cells, and the results of electron microscopy in anatomy, pathology, botany and microbiology. (*In German.*) Vierter Internationaler Kongress für Elektronenmikroskopie, Verhandlungen. Biologisch-Medizinischer Teil. *W. Bargmann, D. Peters, and C. Wolpers, editors.* v. II. 639 pp. 1960. Springer-Verlag, Berlin. (QH211 In8p)

8675 Transformation of *Neisseria meningitidis* by Deoxyribonucleates From Cells and From Culture Slime. Various factors were studied which influence transformation of streptomycin-sensitive meningococci to streptomycin resistance: cellular competence, time of exposure and concentration of transforming DNA, and phenotypic expression. *B. Wesley Catlin.* *Journal of Bacteriology*, v. 79, no. 4, Apr. 1960, p. 579-590.

8676* Absolute Judgements of Odor Quality. Concerns the recognition of odor qualities and the application of information theory to the evaluation of the human observer. *Trygg Engen and Carl Pfaffmann.* *Journal of Experimental Psychology*, v. 59, no. 4, Apr. 1960, p. 214-219.

8677* A Second Example of a Rabbit Red Blood Cell Antigen Resulting From the Interaction of Two Genes. Two new isoantibodies for rabbit blood group antigens were isolated. The antigens detected, called J and K, are controlled by the genes in the *Hg* system. Antigen J occurs as the direct product of the gene Hg^{DJK} and also occurs as an "interaction antigen" in the heterozygote Hg^{A}/Hg^{FK}. Antigen K occurs as the result of the action of the gene Hg^{DJK} or of the gene Hg^{FK}. A revised nomenclature is proposed to include these new antigens. *Carl Cohen.* *Journal of Immunology*, v. 84, no. 5, May 1960, p. 501-506.

8678* Central Nervous System Depressants. I. 4-Alkoxy-3,5-dipropylbenzoic Acids and Derivatives. II. 4-Allyloxy-3,5-dialkylbenzoic Acids and Derivatives. III. 2- and 4-Allyloxy-3,5-Disubstituted Benzoic Acids and Derivatives. IV. 4-Allyloxy-3,5-dialkyl-benzyl Amines. I. *Robert Bruce Moffett, Patrick H. Seay, and William Bradley Reid.* II.-IV. *Robert Bruce Moffett and Patrick H. Seay.* *Journal of Medicinal and Pharmaceutical Chemistry*, v. 2, no. 2, Apr. 1960, p. 179-237.

8679* A Mongol Girl With 46 Chromosomes. A mongol girl, selected because she was born from a young mother, in contrast with reported chromosome findings in mongols, had only 46 chromosomes in her bone-marrow cells and had four small acrocentric chromosomes like normal females. There were only 5, instead of 6, of the longer acrocentric chromosomes (pairs 14, 15, or 16) but an extra chromosome was present that was not certainly distinguishable from chromosome 12; and this may have carried the major part of the genetic material of chromosome 22. A reciprocal translocation between chromosomes 15 and 22 is suggested as the origin of the anomaly. *P. E. Polani, J. H. Briggs, C. E. Ford, C. M. Clarke, and J. M. Berg.* *Lancet*, no. 7127, Apr. 2, 1960, p. 721-724.

8680* Chromosomal Abnormalities in Father and Mongol Child. In the case of a mongol boy the somatic cells had 46 chromosomes, in contrast to the 47 commonly found in mongolism. The mongol's father, an apparently healthy man, was found to have 47 chromosomes in skin cultures. In the mongol there were only 4 short acrocentric chromosomes, instead of 5; but an extra chromosome was present that was similar to those of Pairs Nos. 19 and 20. In the father, the 47th chromosome was similar to those of Pair No. 19. The findings show that fertile, clinically healthy individuals may have a chromosome anomaly and that mongolism may arise from chromosome situations other than the trisomy of Chromosome No. 21. *M. Fraccaro, K. Kaijser, and J. Lindsten.* *Lancet*, no. 7127, Apr. 2, 1960, p. 724-727.

8681* A New Trisomic Syndrome. A female infant presenting with a peculiar facies, webbing of the neck, congenital heart-disease, neonatal hepatitis, and many minor abnormalities was found on postmortem chromosomal study to have an extra chromosome apparently identical to the 17th pair (Ford's nomenclature). This is the second condition of autosomal trisomy to be reported in man. *J. H. Edwards, D. G. Harnden, A. H. Cameron, V. Mary Crosse, and O. H. Wolff.* *Lancet*, no. 7128, Apr. 9 ,1960, p. 787-789.

8682* Multiple Congenital Anomaly Caused by an Extra Autosome. The patient, a girl infant, has 47 chromosomes, the extra chromosome being one of the medium-sized acrocentric autosomes. The presence of this extra chromosome is regarded as the cause of the following observed combination of congenital anomalies: cerebral defect, apparent anophthalmia, cleft palate, hare lip, simian creases, "trigger thumbs", polydactyly, capillary haemangiomata, and heart defect. *Klaus Patau, Eeva Therman, David W. Smith, Stanley L. Inhorn, and Hans P. Wagner.* *Lancet*, no. 7128, Apr. 9, 1960, p. 790-793.

8683* Malformation Syndrome in Man Associated With Triploidy (69 Chromosomes). *J. A. Böök and Berta Santesson.* *Lancet*, no. 7129, Apr. 16, 1960, p. 858-859.

8684 Low-Level Irradiation. Discusses problems brought about by increasing use of atomic energy which results in increased but low levels of radiation exposure. *Austin M. Brues, editor.* 148 pp. 1959. American Association for the the Advancement of Science, Washington, D. C. (QH652 Am35.9L)

8685 Manual of Industrial Radiation Protection. II. Model Code of Safety Regulations (Ionising Radiations). 54 pp. 1959. International Labour Office, Geneva. (QC795 In8m)

8686 Medical Radioisotope Scanning. Proceedings of a seminar jointly organized by the International Atomic Energy Agency and the World Health Organization, Vienna, February,

1959. The International Atomic Energy Agency and the World Health Organization, Proceedings, 266 pp. 1959. International Atomic Energy Agency, Vienna. (RM847 M46)

8687* Indigenous Organic Matter on the Moon. Lunar subsurface material should have an organic fraction easily detectable by simple chemical techniques. ***Carl Sagan.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 393-396.

8688* Biological Contamination of the Moon. The probability of survival of a terrestrial micro-organism, accidentally deposited on the Moon by an impacting lunar probe, has been computed. It is concluded that the probability is very low that deposited terrestrial micro-organisms and organic matter will be confused with indigenous lunar organisms or organic matter; but that the explosive reproduction of terrestrial micro-organisms in indigenous lunar organic matter, and the disruption of the ecologies of hypothetical lunar organisms are remote but non-negligible possibilities. ***Carl Sagan.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 396-402.

8689* The Sustained Growth of Human and Animal Cells in a Protein-Free Environment. ***Harry Eagle.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 427-432.

8690* Strand Separation and Specific Recombination in Deoxyribonucleic Acids: Biological Studies. DNA from *D. pneumoniae* when heated to temperatures where all the molecules are denatured still retains transforming activity. The activity is increased by slowly cooling the denatured DNA as well as by increasing the ionic strength and concentration of DNA during the cooling period. The reunion of the strands is specific and has been shown to occur between populations of denatured molecules of mutant strains of *D. pneumoniae*. The reunion does not occur between the DNA strands of pneumococcus and that from *Streptococcus* D or from organisms with widely varying base ratios. ***J. Marmur and D. Lane.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 453-461.

8691* Strand Separation and Specific Recombination in Deoxyribonucleic Acids: Physical Chemical Studies. When solutions of bacterial DNA are denatured by heating and then cooled, two different molecular states can be obtained in essentially pure form depending on the choice of conditions, that is, rate for cooling, DNA concentration, and ionic strength. One state corresponding to fast cooling consists of single stranded DNA having about half the molecular weight of the original DNA. The other state corresponding to slow cooling consists of recombined strands united by complementary base pairing over most of their length. This form has as much as 50% of its original transforming activity and is called renatured. The quickly cooled, single stranded form is essentially inactive and is called denatured. These two forms are clearly identified by differences in (1) absorbance-temperature curves, (2) density, (3) appearance in electron micrographs and (4) hydrodynamic properties. The recombination depends on concentration in the manner expected for an equilibrium between two independent strands and a bimolecular complex. ***P. Doty, J. Marmur, J. Eigner, and C. Schildkraut.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 461-476.

8692* The Human Chromosomal Satellites in Normal Persons and in Two Patients With Marfan's Syndrome. Chromosomes of three patients with a diagnosis of Marfan's syndrome have been described. One patient with no familial history of the disease, revealed a normal chromosomal constitution. The other two patients' genealogies exhibited the typical pattern of a simple dominant, autosomal defect. Both patients' chromosomes demonstrated a single, abnormally enlarged satellite, in the one case on a chromosome of Pair No. 18, and in the other on No. 21. ***J. H. Tjio, T. T. Puck, and A. Robinson.*** *National Academy of Sciences, Proceedings*, v. 46, Apr. 1960, p. 532-539.

8693* Tumors as Unique Biological Tools in Basic Biochemical Studies. Following chemical challenge of normal and tumor-bearing mice by appropriate biologically active molecules, it is possible to observe subtle tumor-host, tumor-molecule, and tumor-molecule-enzyme relationships at both the *in vivo* and *in vitro* levels. Striking differences in survival time and in certain enzymic responses are obtained between normal and tumor-bearing animals, between various tumor types, and between administered compounds where there may be an alteration of only one atom or merely an isomeric difference. ***Vernon Riley.*** *New York Academy of Sciences, Transactions*, v. 22, no. 5, Mar. 1960, p. 348-364.

8694 Proceedings of the Fourth International Congress of Biochemistry, Vienna, 1958. v. I. Carbohydrate Chemistry of Substances of Biological Interest; v. II. Biochemistry of Wood; v. IV. Biochemistry of Steroids; v. V. Biochemistry of Antibiotics; v. VII. Biochemistry of Viruses; v. VIII. Proteins; v. IX. Physical Chemistry of High Polymers of Biological Interest; v. XIII. Colloquia on Topical Questions in Biochemistry. ***O. Hoffmann-Ostenhof, editor, et al.*** v. I. 206 pp.; v. II, 285 pp.; v. IV, 296 pp.; v. V, 239 pp.; v. VII, 255 pp.; v. VIII, 258 pp.; v. IX, 260 pp.; v. XIII, 474 pp. 1959. Pergamon Press, New York. (QP501 In8p)

8695* The Action of Ultraviolet Radiation on Mammalian Cells as Studied by Single-Cell Techniques. Ultraviolet differs from X-radiation in producing few chromosome breaks, despite its great efficiency of gene mutation. Therefore, in contrast to T2 bacteriophage, which is highly susceptible to single hits of either UV or X-ray, the polyploid mammalian S3 cell is enormously resistant to ultraviolet but is sensitive to death resulting from nonspecific chromosome breaks produced by multiple X-ray hits lodged anywhere in the chromosomal complex. ***H. H. Lee and T. T. Puck.*** *Radiation Research*, v. 12, no. 4, Apr. 1960, p. 340-348.

8696* Abstracts of Papers for the 8th Annual Meeting of the Radiation Research Society, San Francisco, California, May 9-11, 1960. *Radiation Research*, v. 12, no. 4, Apr. 1960, p. 417-485.

8697* Postirradiation Protection of Mice With Lipids. Olive oil, essentially a triolein, protects lethally irradiated male Swiss white mice if it is administered intraperitoneally within an hour after irradiation. This beneficial effect is most pronounced in the mid-lethal dose range where about 90% of the postirradiation oil-treated animals survive. The effect of this oil is manifested during bone marrow phase by an increase in survival, change in mortality distribution, and decrease in weight loss. Preliminary studies indicate that the protective effect of olive oil is due partly, if not entirely, to stimulation of the reticuloendothelial system. ***James K. Ashikawa.*** Abstract of paper from "Abstracts of Papers for the 8th Annual Meeting of the Radiation Research Society, San Francisco, California, May 9-11, 1960". *Radiation Research*, v. 12, no. 4, Apr. 1960, p. 418.

8698 Is Reserpine Tranquilization Linked to Change in Brain Serotonin or Brain Norepinephrine? Because of the very rapid synthesis of serotonin as compared to norepinephrine in brain, the effects of free serotonin may predominate after reserpine action. ***F. Sulser and Bernard B. Brodie.*** *Science*, v. 131, May 13, 1960, p. 1440-1441.

8699* Systemic Toxicological Reactions Resulting From Percutaneous Absorption. Covers some aspects of the problem of percutaneous toxicity as it relates to cosmetic products and other materials that are frequently applied to the skin. ***Fred H. Snyder.*** *Society of Cosmetic Chemists, Journal*, v. 11, no. 3, Apr. 1960, p. 117-127.

8700* Specific Liver and Brain Monoamine Oxidase Inhibition by Alkyl- and Arylalkylhydrazines. ***A. Horita and W. R. McGrath.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 4, Apr. 1960, p. 753-757.

8701* Viral Growth and Oncolysis in Krebs 2 Cells as Affected by Substrate. With three strains of influenza virus, formation of non-infectious cell-associated hemagglutinins in Krebs 2 ascites cells was much greater in a medium containing lactate and glutamine than when glucose was substituted for lactate. Reduction in tumor-producing capacity of cell suspensions by action of influenza virus was correlated with the effect of substrate on HA formation. A marked oncolytic effect was evident in lactate medium at four hours, or before the increase in HA. ***Monroe D. Eaton, Anthony R. Scala, and Harriet C. Rouse.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 4, Apr. 1960, p. 832-836.

8702* Propagation of Mouse Polyoma Virus in a Strain of Mouse Mammary Tumor Cells *in vitro*. Cytopathic effects of the virus were first observed in cultures six days after infection and progressed to complete destruction of all cells by

the 12th day. Increasing cell destruction was accompanied by rise in tissue culture infectivity and hemagglutination titers. Observations with electron microscope revealed presence of virus in infected cells beginning on the sixth day after infection. Virus particles are observed in the nucleus and occasionally in the cytoplasm. ***Roslyn Wallace, M. C. Davies, Barbara Pease, Mary Englert, and A. W. Moyer.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 103, no. 4, Apr. 1960, p. 845-849.

8703* Bibliography of Corneal Transplantation, Lens Transplantation and Vitreous Replacement. Addendum No. 5. ***Lisa Davis and A. E. Maumenee, compilers.*** *Transplantation Bulletin*, v. 7, no. 2, Apr. 1960, p. 430-434.

8704* Bibliography of Hematopoietic Tissue Transplantation. Addendum No. 1. ***Robert Fortuine, Georges Mathé, and Hamilton Baxter, compilers.*** *Transplantation Bulletin*, v. 7, no. 2, Apr. 1960, p. 434-441.

8705* Sanitation in Space. At present, vehicle capability limits the permissible weight for life-support systems to values so small that the open-cycle system is quite adequate. However, the crossover point is within reach, not only through development of larger vehicles, but through steady improvement in the efficiency of auxiliary power supplies. ***Laurel van der Wal.*** *Water Pollution Control Federation, Journal*, v. 32, Apr. 1960, p. 333-343.

8706* Electric Double Refraction of Tobacco Mosaic Virus Solutions as a Function of Heating. (*In German.*) Elektrische Doppelbrechung von Tabakmosaikvirus-Lösungen in Abhängigkeit von der Erwärmung. ***W. Pavlitschek.*** *Zeitschrift für Naturforschung*, v. 15b, Mar. 1960, p. 153-163.

8707* The Problem of Evolution of Present Infectious Diseases. Sanitary conditions in the fifty years before the Socialist Revolution and since are compared, and statistic data given concerning tuberculosis, different types of typhus, diphtheria, sporadic diseases and intestinal infections. Much stress is laid on government-enforced and general improvement of hygienic conditions, in addition to scientific progress, as a chief factor of the fight against infectious diseases in Russia. (*In Russian.*) Problema evoliutsii sovremennykh infektsionnykh bolezneĭ. ***S. N. Muromtsev.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 31, no. 4, Apr. 1960, p. 5-9.

8708* Concerning the Efficacy of the Inhalation Method of Vaccination. II. Immunological Efficacy of the Inhalation Method of Immunization by Means of Killed Bacteria Vaccines in Using Medium and Fine-Dispersed Aerosols. Vaccine aerosols with the particles ranging in size four to ten micron secured much higher immunological indices than those made up of larger particles. In triple immunization of rabbits with the finely dispersed vaccine aerosol the average agglutinin titres reached 1:29440; the latter were 8.3 times greater than those obtained in a triple subcutaneous vaccination. (*In Russian.*) K voprosu ob effektivnosti ingaliatsionnogo sposoba vaktsinatsii. II. Immunologicheskaia effektivnost' ingaliatsionnoĭ immunizatsii ubitymi vaktsinami pri ispol'zovanii srednedispersnykh i melkodispersnykh aerozoleĭ. ***A. I. Maslov.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 31, no. 4, Apr. 1960, p. 10-15.

8709* Experimental Inhalation Immunization of Animals With Pertussis Vaccine. This method, according to the level of antigens on the 10th - 20th day after triple immunization, is almost equivalent to the subcutaneous method, although in the first case the total amount of vaccine was two to three times lesser. (*In Russian.*) Ingaliatsionnaia immunizatsiia kokliushnoĭ vaktsinoĭ v eksperimente na zhivotnykh. ***A. I. Spitsa.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 31, no. 4, Apr. 1960, p. 130.

CERAMICS AND CONCRETE

8710 Tests for Potential and Past Moisture Expansion of Ceramic Building Units. The tests originally proposed by Schurecht for the estimation of potential and past moisture expansion of whiteware and the modifications recently proposed by McBurney for application of burnt clay building units are critically examined. The measured expansion of bricks standing in air and of replicates treated in the autoclave show that this latter test cannot be used to give a reliable estimate of the probable natural expansion of such bodies. ***E. H. Waters, J. S. Hosking, and H. V. Hueber.*** *ASTM Bulletin*, no. 245, Apr. 1960, p. 55-59.

8711 Movement of Sodium With Water in Neat Portland Cement. Sodium moves freely with water; a portion of the Na tends to be bound with the cement and to distribute itself with uniform concentration through a mass of concrete. ***R. C. Hall and J. M. Rhodes.*** *ASTM Bulletin*, no. 245, Apr. 1960, p. 66-69.

8712 Vaporization of Rare-Earth Oxides. A study of the vaporization of La_2O_3, Nd_2O_3, and Y_2O_3 at high temperatures was carried out by the Knudsen effusion technique. The methods employed, the results of the measurements, and the low-temperature heat capacities of these materials are discussed. ***Patrick N. Walsh, Harold W. Goldstein, and David White.*** *American Ceramic Society, Journal*, v. 43, May 1960, p. 229-233.

8713 Low-Temperature Equilibria Among ZrO_2, ThO_2, and UO_2. Contrary to earlier work, only 8 mol. % ZrO_2 dissolves in UO_2 and less than 4 mol. % of UO_2 in ZrO_2 at temperatures up to 1309 C. A continuous series of solid solutions can be made between ThO_2 and UO_2 at 1300 C, and extensive defect fluorite solid solutions can be prepared between ThO_2 and U_2O_5. ***F. A. Mumpton and Rustum Roy.*** *American Ceramic Society, Journal*, v. 43, May 1960, p. 234-240.

8714 Effect of Impurities and Heat-Treatment on Ductility of MgO. Stress-strain curves were obtained in flexure and in tension on single crystals. A decrease in Fe content and high-temperature heating and rapid cooling caused a decrease in strength and increase in ductility. ***A. E. Gorum, W. J. Luhman, and J. A. Pask.*** *American Ceramic Society, Journal*, v. 43, May 1960, p. 241-245.

8715* Differential Shrinkage in Composite Beams. Due to normal aging and curing processes, shrinkage occurs in a slab when it is cast onto precast prestressed beams. This shrinkage induces stress into the composite beam and slab construction causing the beams to deflect. An analytical method is presented for predicting the sag. ***Halvard W. Birkeland.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 11, May 1960, p. 1123-1136.

8716* Plastic Forms for Architectural Concrete. Pleasing and unusual architectural effects in concrete are being obtained by the use of forms made of plastics. The architectural treatment may consist of both surface finish and bold pattern decoration. The concrete surfaces can be either glossy-smooth or textured. In either case, the surface is free of open air and water pockets. No special facing mixes, no parting agents, and no polishing or grinding are required. The extremely fine smooth finish of plastic-formed concrete greatly improves the attractiveness of integral colors, and due to the high reflectivity, smaller amounts of pigments are required to obtain a given color intensity. A considerable number of reuses are obtainable with the plastic forms, thus reducing the cost through multiple use. Laboratory tests established optimum curing conditions for this type of architectural concrete. It was found that temperature control is important if a high degree of reflectivity is desired. Although the present development of plastic forms was initiated only three years ago, a considerable number of applications have been made in the field. Several of these are described. ***J. A. Hanson.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 11, May 1960, p. 1137-1148.

8717* Corrosion Processes in Refractory Bricks in Chemical Kilns. Zirconia, zirconium crystoballite, and corundum bricks containing more than 99% Al_2O_3 have been developed as a new highly refractory brick. Their properties were tested by contact reactions in reducing kiln atmospheres and in sodium sulphate vapor, and also in attack by oil ash. Conclusions on suitable applications in chemical kilns were drawn on the basis of these tests. (*In German.*) Korrosionsvorgänge an feuerfesten Steinen in Chemieöfen. ***Eduard Steinhoff.*** *Chemie-Ingenieur-Technik*, v. 32, Apr. 1960, p. 267-278.

8718 Thermal Expansion and Shrinkage Measurements of Refractory Clays and Materials. Certain refractory clays

show a turning point in the expansion/shrinkage curve after the main shrinkage. The turning point is due to the formation of a glass phase; its temperature corresponding to the densification-temperature of the clay. A similar turning point was also found in test bodies made up from mixtures of corundum and clay or silica. On replacing the α-alumina with β- or γ-alumina a curve without a turning point was obtained. Mullite is formed in every case, there being two possibilities for its formation depending upon the composition of the starting material. (*In German.*) Über einige Ergebnisse von Wärmedehnungs- und Schwind-ungsmessungen an feuerfesten Tonen und Massen. ***H. F. Reich.*** *Deutsche Keramischen Gesellschaft, Berichte,* v. 37, Mar. 1960, p. 103-115.

8719* High-Frequency Drying of a Ceramic Mass. Describes possible preheating, continuous, and impulse drying processes, discusses the theoretical fundamentals and deals with the conditions encountered in continuous drying. From this, the conditons applying to impulse drying are derived, a process which allows a considerable increase in the voltage applied at the electrode plates of the capacitor without any danger to the material to be dried. (*In German.*) Hochfrequenztrocknung einer keramischen Masse. ***H. H. Halling.*** *Elektrowärme,* v. 18, Mar. 1960, p. 62-66.

8720* The Character of the High-Temperature Phase Transition in Some Solid Solutions of $BaTiO_3$-$BaSnO_3$. (*In Russian.*) O kharaktere vysokotemperaturnogo fazovogo perekhoda v nekotorykh tverdykh rastvorakh $BaTiO_3$-$BaSnO_3$. ***S. V. Bodanov and R. I. Razbash.*** *Fizika Tverdogo Tela,* v. 2, no. 4, Apr. 1960, p. 670-672.

8721 Effect of Partial Replacements of Soda by Lithia in Opal and Alabaster Glass. Lower operating temperatures and the concomitant savings should result from the more fluid lithia glasses. The improved light transmission of the lithia glasses should find application in the illuminating field. ***H. W. Rauch, C. H. Commons, Jr., and A. Silverman.*** *Glass Industry,* v. 41, May 1960, p. 261 + 3 pages.

8722 Glass for Disposing of Fission Products. A method of incorporating fission products into glass was devised and demonstrated. The glass immobilizes the fission products to a high degree even if it is immersed in water. The glass can be stored in a dry location with negligible risk of dispersing fission products. ***L. C. Watson.*** *Glass Industry,* v. 41, May 1960, p. 264 + 6 pages.

8723 Electric Boosting and Bubbling for Glass Furnaces. Bubbling improves homogeneity, reduces fuel consumption and furnace temperatures, decreases loss in stones, and increases production. An electric boosting system increases production. ***Larry Penberthy and Fred Scarfe.*** *Glass Industry,* v. 41, May 1960, p. 274 + 4 pages.

8724 Attack of Graphite by an Oxidising Gas at Low Partial Pressures and High Temperatures. Experiments were made to determine the kinetics of the oxidation of graphite at 900-1000 C in argon containing small amounts of O, water vapor, CO_2, H, and CO. The reactivity of the gases decreased in the order O, water vapor, CO_2. ***J. E. Antill and K. A. Peakall.*** *Journal of Nuclear Materials,* v. 2, no. 1, Mar. 1960, p. 31-38.

8725* Investigations of the Infrared Spectrum of Silicates. II. Determination of the Structural Role of Titanium in Certain Silicates. Infrared spectra of titaniferous garnet showed that Ti exists in coordination 4 and partially replaces Si. There was no indication of the presence or absence of hexacoordinated Ti. (*In French.*) Recherches sur le spectre infrarouge des silicates. II. Détermination du rôle structural du titane dans certains silicates. ***P. Tarte.*** *Silicates Industriels,* v. 25, no. 4, Apr. 1960, p. 171-175.

8726 Symposium on the Fusion of Glass. Proceedings of symposium held in Brussells, Oct. 6-10, 1958. Papers cover initial materials and vitrifiable mixtures, scientific and technical aspects of fusion, glass considered as a material, and synthesis aspects. (*In French.*) Symposium sur la fusion du verre. 963 pp. Union Scientifique Continentale du Verre, Charleroi, Belgique. (TP845 Un3s)

8727 Sintering Studies on the System UO_2-PuO_2. II. Sinterability. Uranium dioxide containing UO_2-PuO_2 solid solution type additions results in greater densification rates than does UO_2 containing UO_2-PuO_2 physical mixture type additions. Solid solutions formed by sintering, when ground and resintered, also densify more rapidly than do two phase mixtures. ***T. D. Chikalla.*** *U. S. Atomic Energy Commission, HW-63081,* Dec. 17, 1959, 38 pp. (UF767 Un3.1hw Contin.)

8728 Uranium Glasses. I. Fundamental Considerations. The principles involved in forming glasses containing U are discussed. Materials having low thermal neutron cross sections that could be useful components in a U glass are listed and their properties are discussed. ***C. D. Wirkus and D. R. Wilder.*** *U. S. Atomic Energy Commission, IS-107,* Feb. 1960, 19 pp. (UF767 Un3.1isu Contin.)

CHEMICAL ENGINEERING

8729* Annual Review of the Literature on Fats, Oils, and Detergents. 1. ***I. I. Rusoff.*** *American Oil Chemists' Society, Journal,* v. 37, May 1960, p. 223-242.

8730 A New Membrane Filter. This cellulosic film, approximately 150 microns thick, contains millions of capillary pores of uniform size. Offers a wide range of application in pharmacy practice. ***William H. Briner and Milton W. Skolaut.*** *American Pharmaceutical Association, Journal (Practical Pharmacy Ed.),* v. 21, May 1960, p. 287-289.

8731 Separation of Microorganisms by Flotation. I. Development and Evaluation of Assay Procedures. II. Flotation of Spores of *Bacillus subtilis* var. *niger*. Two assay methods have been devised to aid in evaluating flotation tests. A chemical method based upon the dipicolinic acid content of spores is used for the quantitative determination of spores, whereas a direct count method assays for dormant spores, germinated spores, and vegetative cells. The age of the spore material at harvest, the soluble-salt content of the flotation feed, prior heating of the pulp, pH of the pulp, and the addition of amine or fatty-acid collectors influence the flotation behavior of *Bacillus subtilis* spores. I-II. ***A. M. Gaudin, A. L. Mular, and R. F. O'Connor.*** *Applied Microbiology,* v. 8, no. 2, Mar. 1960, p. 84-97.

8732 Water Conditioning in the Production of Ferroalloys. The analysis of well and creek water, and the use of well water are described. ***J. R. Lee and V. H. Street.*** *Blast Furnace and Steel Plant,* v. 48, May 1960, p. 470-471.

8733* Steam-Stripping of Carbon Dioxide From Soda-Lye Solutions. Studies in a bubble-cap plate column show the influence on the process of variations in inlet steam and CO_2 feed rates. ***D. Bhargava, G. N. Bhat, and E. Weingaertner.*** *British Chemical Engineering,* v. 5, May 1960, p. 320-325.

8734* Pressure Drop, Loading and Flooding in Irrigated Packed Towers. Reviews the available correlations and proposes an improved correlation to cover different gases and liquids. ***H. E. Eduljee.*** *British Chemical Engineering,* v. 5, May 1960, p. 330-334.

8735* The Production of Acetylene by the Partial Oxidation of Methane. Acetylene manufacture by the controlled combustion of methane and the various types of burners used are reviewed. ***C. Cirloganu.*** *British Chemical Engineering,* v. 5, May 1960, p. 346-350.

8736 Catalysis. Oxidation, Hydration, Dehydration and Cracking Catalysts. Cracking catalysts, catalytic dehydration and hydration, hydrocarbon oxidation, oxidation of NH_3, NH_3 and CH_4, CO and SO_2, mechanism of catalytic oxidation, miscellaneous catalytic oxidations are discussed. ***Paul H. Emmett, editor.*** v. VII. 378 pp. 1960. Reinhold Publishing Corp., New York. (QD501 Em64c)

8737 Tall Oil Fractionator Capacity Tripled. Change in reflux ratio, close control of variables give more product with no new equipment. *Chemical and Engineering News,* v. 38, no. 20, May 16, 1960, p. 66-67.

8738 Unsteady-State Heat Transfer. II. Because the physical properties and thermodynamic state of a solid depends on

position as well as time, differential heat-transfer equations are necessary to describe the thermodynamic behavior of the solid phase. ***Sam H. Davis, Jr. and William W. Akers.*** *Chemical Engineering*, v. 67, May 16, 1960, p. 151 + 4 pages.

8739 Novel Scrubber Adjusts for Variable Flows. Flooded disk operates automatically at constant pressure drop to maintain high scrubbing efficiency. *Chemical Engineering*, v. 67, May 30, 1960, p. 70 + 1 page.

8740 Pure Propylene Feeds Growing New Resin Industry. The propylene unit at Marcus Hook, Pa., is described. Photos and sketches are cited. *Chemical Engineering*, v. 67, May 30, 1960, p. 78-81.

8741 Process Plant Design. A combination of systems engineering and process design produces a plant flowsheet for manufacture of a product. ***Theodore J. Williams.*** *Chemical Engineering*, v. 67, May 30, 1960, p. 97-102.

8742* New Manufacturing Process of Anionic and Non-Ionic Surface-Active Agents From Heavy Oils. Stresses the fact that, as the process is initially based on an autothermal cracking, in continuous flow of the heavy oils under treatment it presents great economical interest owing to its low cost of installation and to its high thermal yield. (*In French.*) Fabrication d'agents tensioactifs anioniques et non ioniques à partir des huiles lourdes de pétrole. ***Byouk Blouri and Henry Gault.*** *Chimie & Industrie*, v. 83, no. 4, Apr. 1960, p. 549-556.

8743* Chlorination of Hydrocarbons in Gaseous Phase. Studies led to two types of processes: adiabatic technics and isothermic technics which utilized fluidization. Applications of these processes are reviewed for the preparation of hexachlorobenzene, CCl_4, C_2HCl_3, and C_2Cl_6. (*In French.*) Chloration des hydrocarbures en phase gazeuse. ***J. Kraft, R. Thermet, and L. Parvi.*** *Chimie & Industrie*, v. 83, no. 4, Apr. 1960, p. 557-563.

8744* Separating Methods for Mixture Components. Thermodynamic Basis and Classification. Distinguishes between transfer phenomena without change of phase and separation by transfer from phase to phase, thus leading to a study of the part of the extracting solvent. (*In French.*) Les méthodes de séparation des constituants des mélanges. Bases thermodynamiques et classification. ***Pierre Le Goff.*** *Chimie & Industrie (Génie Chimique)*, v. 83, no. 4, Apr. 1960, p. 93-102.

8745* Fluid Cleaning and Filtration. Methods of cleaning fluids such as lubricating oils, engine fuels and hydraulic liquids, and their application. ***K. E. Nicholds.*** *Engineering Materials and Design*, v. 3, June 1960, p. 346-349.

8746 Fifth World Petroleum Congress, Proceedings. Proceedings of World Petroleum Congress held in New York, June 1-5, 1959. Consists of a general volume plus ten separate sections on the following subjects: geology and geophysics; drilling and production; oil processes and refining; chemicals from petroleum and natural gas; composition, analysis, and testing; utilization of petroleum products; engineering equipment and materials; transport and distribution; statistics and education; and symposium on the applications of atomic energy to the petroleum industry. General Volume and v. I-X. General Volume, 338 pp.; v. I., 1099 pp.; v. II. 422 pp.; v. III., 429 pp.; v. IV., 334 pp.; v. V., 428 pp.; v. VI., 468 pp.; v. VII., 348 pp.; v. VIII., 251 pp.; v. IX., 196 pp.; v. X., 228 pp. 1959. Fifth World Petroleum Congress, Inc., New York. (TN863 C76a5)

8747 Pipeline Transportation of Energy. Prospects for technological improvements in pipelining are almost limitless. Full automatization of all pipelines remains. The transportation of ground coal in pipelines will develop further. ***Orville S. Carpenter.*** *Financial Analysts Journal*, v. 16, no. 3, May-June 1960, p. 127 + 4 pages.

8748* Refrigerating Concentration of Natural Gas Well Brine. The natural gas well brine of Chiba Pref. is concentrated by freezing. Nine samples of concentrations up to 20 wt. % are prepared and the contents of components are analyzed. Sodium, K, Mg, Cl, Br, and I are concentrated in strict proportion to the degree of concentration, but Ca, total Si and B precipitate during concentration. (*In Japanese.*) ***Shuji Umano, Ichiro Hayano, and Shigetake Kawasaki.*** *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 55, Mar. 1960, p. 11.

8749 Chemical and Mechanical Stabilization. Design and construction of base courses, organic cationic chemicals as stabilizing problems for Iowa loess, additives as aids to asphalt stabilization of fine-grained soils, application of mechanical stabilization to an arctic beach, stabilization of fine and coarse-grained soils with lime-flyash admixtures are discussed. *Highway Research Board, Bulletin* 129, 1956, 110 pp. (TE1 H53b Contin.)

8750 The Plasma Jet in Chemical Synthesis. New methods for making high-temperature materials as well as endothermic compounds are constantly sought. The plasma jet may be used to produce such materials. Titanium and magnesium nitrides, nitrogen tetroxide, and cyanogen were synthesized, using a nitrogen plasma jet. ***C. S. Stokes and W. W. Knipe.*** *Industrial and Engineering Chemistry*, v. 52, Apr. 1960, p. 287-288.

8751 The Plasma Jet in High Temperature Research. A new, refined plasma jet was constructed. It permits unobstructed observation of the complete arc process through a glass chamber. The ionization of monatomic and diatomic stabilizing gases in the plasma process occurs in successive stages. ***Sidney Katz, Edwin J. Latos, and Elliott Raisen.*** *Industrial and Engineering Chemistry*, v. 52, Apr. 1960, p. 289-290.

8752 Falling Liquid Sheets. A New Mass Transfer Device. Taut strings approximately parallel and vertical may be arranged to produce dynamic liquid sheets approximately four feet long. A liquid sheet column 1.5 x 3 inches was built with the sheets 0.25 inch apart. Tests on the performance of this column were made by absorbing NH_3 and CO_2 from air into water. Near flooding the pressure drop through the column was approximately 0.2 inch of water per foot of column height. ***LeRoy A. Bromley, Stanley M. Read, and Sargit S. Bupara.*** *Industrial and Engineering Chemistry*, v. 52, Apr. 1960, p. 311-312.

8753 Non-Flammable Liquid Mixtures and Safety Solvents. In many processes involving the use of flammable liquids, non-flammable liquids are added to reduce the fire hazard. Indicates the principles which should underlie the composition of these mixtures. ***E. H. Coleman.*** *Industrial Chemist*, v. 36, May 1960, p. 211-214.

8754 The Removal of Sulphuric Acid Mist. An account of the plant for treatment of exit gases operated by the South Eastern Gas Board in conjunction with their Kachkaroff sulfuric acid plant. ***H. G. Markward.*** *Industrial Chemist*, v. 36, May 1960, p. 220-222.

8755 Industrial Applications of the Metal Organic Compounds. Describes the industrial applications of alkaline earth organic compounds and their future possibilities. ***J. H. Harwood.*** *Industrial Chemist*, v. 36, May 1960, p. 223-228.

8756* Miscible Displacement Processes or Miscible-Drive. Processes are comparatively recent techniques for secondary recovery. Although the first trials have not always shown the expected results, they have been encouraging. Includes a bibliography of American articles. (*In French.*) Les déplacements miscibles ou "miscible-drive". ***G. Manasterski.*** *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides*, v. 15, Mar. 1960, p. 480-495.

8757* Contribution to the Investigation of Distillation. III. Exchange of Substance Between Phases. The whole phenomenon of rectification, the thermodynamic investigation of equilibrium between liquid and vapor and of the exchange of substance between the phases is considered. Problems studied are: improvement of the observation of boiling points; investigation of the thermodynamic equilibrium of liquid vapor and the prediction of azeotropism, and the evolution of the azeotropism with pressure; and exchange of substance between the phases. (*In French.*) Contribution a l'étude de la Distillation. ***I. Kaiser.*** *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides*, v. 15, Mar. 1960, p. 598-626.

8758 Can Designers Meet Demands of Ultra-Low Temperatures? Copper, aluminum alloys, austenitic stainless steels are advantageous in low-tempearture work; very high-quality insulations are used for ultra-low-temperature service. ***W. K. Sutton.*** *Iron Age*, v. 185, no. 19, May 12, 1960, p. 154-156.

8759* Production of β-Chloroethers From Unsaturated Hydrocarbons Obtained by Cracking in the Vapor-Phase Method. Tubular reactors were tested in the production of β-chloroisopropylethyl ether from propylene obtained by cracking. The yield of chloroether depends on the relationship of the reacting substances, the volume speed, and the presence of neutralizing HCl. With a volume speed of 300, 270, and 180 liters per minute in the reacting substances, 63 to 65% of chloroether is formed. Taking the absorbed propylene into account, the ether yield is 26 to 28%. (*In Russian.*) Poluchenie β-khlorefirov iz nepredel'nykh uglevodorodov krekinga parofaznym metodom. ***A. K. Seleznev and I. G. Prigornev.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Neft' i Gaz*, v. 3, no. 3, 1960, p. 63-68.

8760* Electric and Catalytic Properties of Iron-Aluminum Oxide Catalysts. Activation energy of the conductivity is constant and independent of the composition of the Fe-Al catalyst. The specific speed constant and specific electric conductivity of the Fe-Al catalyst increase with the growth of the Fe_2O_3 content in the catalyst. There is a functional relationship between the electric conductivity of the Fe-Al catalyst and the specific catalytic activity (*In Russian.*) Electricheskie i kataliticheskie svoĭstva zhelezo-aliumookisnykh katalizatorov. ***T. G. Alkhazov and M. S. Belen'kiĭ.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Neft' i Gaz*, v. 3, no. 3, 1960, p. 73-80.

8761* Investigation of Phase Equilibria of the Methane-N-Hexane System. This system of constant composition (85 mol.% methane) was tested in the critical region between 100 and 250 atm and between 0 and 70 C. The isotherms of the specific volumes evince a discontinuity in the retrograde dew points near the critical temperature. A phase diagram of the mixture was drawn and the critical point was determined by the parameters $P_{cr} = 200.5$ atm and $t_{cr} = 8$ C. (*In Russian.*) Issledovanie fazovykh ravnovesiĭ sistemy metan-N-geksan. ***G. S. Stepanova.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Neft' i Gaz*, v. 3, no. 3, 1960, p. 113-116.

8762 Manual on Industrial Water and Industrial Waste Water. With New and Revised Methods—1959. Industrial water, general uses and problems of sampling and analysis; standards on industrial water and industrial waste water; definitions, sampling methods, analytical methods, corrosivity tests, methods of reporting, precision of methods, and classification are discussed. 2nd Ed. 658 pp. 1960. American Society for Testing Materials, Philadelphia. (TD353 Am35m2)

8763 Estimation of Long-Time Performance of Extruded Plastic Pipe From Short-Time Burst Strength. High-density polyethylene, acrylonitrile-butadiene-styrene, high-impact polyvinyl chloride, and normal-impact polyvinyl chloride thermoplastic pipe were examined. Master rupture curves were obtained by plotting short-term burst strengths versus the parameter. The master curves were used to predict rupture properties for different periods of time. ***S. Goldfein.*** *Modern Plastics*, v. 37, no. 9, May 1960, p. 139 + 4 pages.

8764* Radiation in the Chemical Industry. I-II. Research into the effects of radiations on living organisms has clearly indicated the amazing complexity and diversity of chemical reactions which can be induced. Much thought has been given to the possibilities of bringing such nuclear forces to bear on the manufacture of various commodities for the use of mankind either by making present chemicals by new and cheaper methods, or with greater purity, or by preparing chemicals which could not be made by other means. Although fission products are becoming more and more plentiful, no actual manufacture of chemical compounds has taken place because of the high costs. The main obstacle is the high intensity radiation required for economical operation. Applications considered in these papers, in addition to such general processes as sterilization and polymer modification, are conversion of benzene to aniline, nitric acid from atmospheric nitrogen, coal gasification, lowered temperature reactions, directed polymerization of specialty plastics, vulcanizing, and some others. ***F. R. Paulsen.*** *Nuclear Energy*, v. 14, Apr. 1960, p. 163-165; v. 14, May 1960, p. 221-223.

8765 Safe, Orderly, Efficient Startup-Shutdown Procedures Don't Just *Happen*—They're *Planned*. Distillation units are increasing in capacity and size, tankage is being reduced or eliminated, and refineries are being streamlined. For the sake of safety, continuous operation, and minimum cost it pays to review startup-shutdown procedures occasionally. ***W. S. Bonnell and J. A. Burns.*** *Oil and Gas Journal*, v. 58, no. 20, May 16, 1960, p. 131-134.

8766 Towers Are Touchy. Coming on and off stream with primary distillation equipment can spell trouble. Here's one company's experience with this problem and an outline of its procedure for startup of vacuum towers and shutdown of crude-oil towers. ***R. W. Ballmer.*** *Oil and Gas Jounal*, v. 58, no. 20, May 16, 1960, p. 166 + 3 pages.

8767 New Hydrocracking Process Offers Refiners More Flexible Gasoline-Distillate Output. Process uses fixed catalyst bed, produces no catalyst deposit, and can use a wide variety of charge stocks. *Oil and Gas Journal*, v. 58, no. 21, May 23, 1960, p. 102 + 2 pages.

8768* Sprayon Operation Features Automatic Filling Line. The development of the Sprayon plant and the application of aerosol products are discussed. *Paint and Varnish Production*, v. 50, no. 6, May 1960, p. 44-46.

8769* Hydrogen Processing . . . in Modern Refining. Hydrogen processing is applicable in modern refining to reduce the number of treating processes, to provide feed stocks which improve processing yields and decrease catalyst usage, and to eliminate either coke or No. 6 fuel oil marketing problems. ***C. E. Slyngstad and F. L. Lempert.*** *Petroleum Engineer*, v. 32, May 1960, p. C13-C18.

8770* Hydrogenation of Catalytic Cracking Feedstocks. Catalytic cracking feedstock quality has been shown to be adversely affected by the presence of polyaromatic compounds, N bases, and trace metal contaminants such as Ni and V. These undesirable constituents can be removed or altered by hydrogenation. ***C. C. Williams and M. D. Abbott.*** *Petroleum Engineer*, v. 32, May 1960, p. C25-C28.

8771 How Much You Can Save With the Isocracking Process. Material balances for typical refineries converting middle distillate to gasoline demonstrating the advantage of the isocracking process for control of product distribution and quality. ***J. W. Scott, J. A. Robbers, N. J. Paterson, and H. M. Lavender.*** *Petroleum Refiner*, v. 39, May 1960, p. 161-168.

8772 How Cap Spacing Sets Tower Design. A new method for determining the maximum vapor or gas capacity of bubble cap towers combining the main features of bubble cap tray design into two mathematical expressions. ***L. S. Gyökhegyi, J. J. Hay, and J. J. Csermann.*** *Petroleum Refiner*, v. 39, May 1960, p. 201-206.

8773* High Density Polyethylene Pipe for Low Pressure Gas Gathering Systems. Field experience together with installation cost studies show that high-density polyethylene pipe can satisfactorily be used for low-pressure gas gathering systems at less expense than steel pipe. ***Leo B. Croley.*** *Pipe Line News*, v. 32, May 1960, p. 42 + 5 pages.

8774 Positive-Displacement Pumps. Charts quickly give values for power, efficiency and suction. Compares positive-displacement pumps with other basic types listing advantages and limitations. ***Warren E. Wilson.*** *Product Engineering*, v. 31, no. 23, June 6, 1960, p. 42-51.

8775* Problems Connected With the Large Scale Manufacture of Urea. Covers the consumption of raw materials, use of methods without recirculation or with full recirculation of NH_3, CO_2 or the application of a reflux of aqueous carbamide solutions, methods of urea synthesis by the separative recirculation of NH_3 and CO_2, and the apparatus used. (*In Polish.*) Problemy związane z produkcją mocznika w wielkiej skali. ***Eugeniusz Błasiak.*** *Przemysł Chemiczny*, v. 39, no. 3, Mar. 1960, p. 133-137.

8776* Large Capacity Vehicle Container for High Pressure Gas. Vehicle containers for high pressure gas are subjected to specially strict safety regulations. A large capacity container vehicle was made of a fine grain steel, the chemical analysis of which is indicated. (*In German.*) Grossraum-Kesselwagen für Druckgas. ***W. Wolff and F. Hildebrand.*** *Schweissen und Schneiden*, v. 12, May 1960, p. 220 + 1 page.

8777* The Evolution of Linalyl Acetate and Linalol During the Extractive Hydro-Distillation of Certain Essential Oils. The evolution of linalyl acetate and linalol under the action of aqueous solutions of organic acids show that the compounds resulting from this reaction, viz.: myrcene, ocimene, racemic linalol, and others, are not elaborated by those plants. ***Laurent L. Crabalona.*** *Soap, Perfumery & Cosmetics,* v. 33, May 1960, p. 495-503.

8778* The Location of the Sulfonic Acid Groups in Lignosulfonic Acids. When lignosulfonic acids are subjected to a treatment with an acid mixture (HI, HCl and H_3PO_2) ⅓ to ⅔ of the sulfonic acid groups are split off rapidly, the remaining groups being eliminated very slowly. This cleaving reaction was studied using various model compounds essentially of the phenylpropane sulfonic acid type. (*In German.*) Über die Bindungsstellen der Sulfogruppen in Lignosulfonsäuren. ***Josef Gierer, Bo Alfredsson, and Sigurd Söderberg.*** *Svensk Papperstidning,* v. 63, no. 7, Apr. 15, 1960, p. 201-207.

8779* Usefulness of Rheology in Cosmetics. The report supplies answers to puzzling changes in emulsion properties. Cosmetic chemists have in precise rheology a tool which will enable them to create new types of emulsions with novel cosmetic effects. ***Herbert Heinrich and John E. Clements.*** *Toilet Goods Association, Proceedings of the Scientific Section,* no. 33, May 1960, p. 16-22.

8780 Fabrication of the Type "E" Fluorine Cell Tank. The design and fabrication techniques utilized in the construction of an improved 6000 amp. F cell tank at the Paducah Plant is expected to increase the service life of the tank by a margin of greater than two to one. ***B. W. Clark.*** *U. S. Atomic Energy Commission,* KY-326, May 5, 1960, 23 pp. (UF767 Un3.1Ky Contin.)

8781* Trickling Filter Theory. Hydraulic load and depth of filter are two of the major factors which determine efficiency in trickling filter operation. BOD removal is related to hydraulic loading, which is related to the depth of the filter, and the combination of the two predict contact time. This group of variables is expressed mathematically and justification for the equation is supported by experimental data. Two factors not considered are temperature and recirculation. ***K. L. Schulze.*** *Water & Sewage Works,* v. 107, Mar. 1960, p. 100-103.

8782* Liquid Chemical Feeders. Review of the fundamentals of feeding liquids and slurries. ***Virgil W. Langworthy.*** *Water & Sewage Works,* v. 107, Mar. 1960, p. 124-125.

8783* Laboratory Studies of Removal and Segregation of Fission Products From Reactor Wastes. By combining cocrystallization, coprecipitation, and liquid-liquid extraction, the Cs and Sr activities can be segregated from other fission products on potassium alum and barium sulfate, respectively, while the rare earths, Zr, Y, Nb, and Ru can be removed into undiluted tributyl phosphate. ***Herman L. Krieger, Abraham S. Goldin, and Conrad P. Straub.*** *Water Pollution Control Federation, Journal,* v. 32, May 1960, p. 495-504.

See also: **8717** (corrosion of refractory brick in chemical kilns); **8858** (ion exchange resins from lignite coal); **9167** (future of energy in chemical industry); **9221** (liquid fuels from CO hydrogenation); **9223** (Fischer-Tropsch synthesis).

CHEMISTRY—ANALYTICAL

8784* Light-Scattering Methods for the Chemical Characterisation of Polymers. A Review. *F. W. Peaker.* *Analyst,* v. 85, Apr. 1960, p. 235-244.

8785* The Determination of Zinc in Metallurgical Materials by Atomic-Absorption Spectrophotometry. The method has been applied to a wide range of typical metallurgical samples, and results compare favorably with those obtained by more time-consuming conventional procedures. Readily available equipment is used, and the method is rapid and simple to apply. ***J. A. F. Gidley and J. T. Jones.*** *Analyst,* v. 85, Apr. 1960, p. 249-256.

8786* The Determination of Ketone Bodies in Blood. The method is based on the conversion of all ketone bodies to acetone, distillation of acetone and its subsequent colorimetric determination by reaction with ethanolic salicylic aldehyde to form dihydroxydibenzene acetone in alkaline solution. ***R. L. Reid.*** *Analyst,* v. 85, Apr. 1960, p. 265-271.

8787* Separation and Gravimetric Determination of Niobium, Tantalum and Titanium by Precipitation With N-Benzoyl-N-Phenylhydroxylamine. *F. J. Langmyhr and T. Hongslo.* *Analytica Chimica Acta,* v. 22, no. 4, Apr. 1960, p. 301-305.

8788* A Systematic Scheme of Qualitative Analysis for Anions. V. A Simplified Scheme for the Detection of Common Anions. *I. K. Taimni and Manohar Lal.* *Analytica Chimica Acta,* v. 22, no. 4, Apr. 1960, p. 311-314.

8789* Titration of Mercury(II) With Sodium Tetraphenylboron. A direct visual titration of mercury (II) with sodium tetraphenylboron ("Kalignost") is described. Phenylmercuric salts are formed and the end-point is indicated by a turbidity of insoluble diphenylmercury. ***A. Heyrovský.*** *Analytica Chimica Acta,* v. 22, no. 5, May 1960, p. 405-408.

8790* Rapid Method for the Determination of Fluoride in Liquids. The samples are burned in a modified Beckman oxy-hydrogen burner. The fluoride is scrubbed out of the products of combustion and determined in any conventional manner. ***S. A. Bartkiewicz and J. W. Robinson.*** *Analytica Chimica Acta,* v. 22, no. 5, May 1960, p. 427-431.

8791* A Dinitrophenylation Method for the Microdetermination of Amide Nitrogen. A new micro-method is reported for the determination of amide nitrogen, based on the estimation of 2,4-dinitroaniline produced by the reaction between ammonia, quantitatively liberated from the protein, and 1-fluoro-2,4-dinitrobenzene. ***J. H. Bradbury.*** *Analytica Chimica Acta,* v. 22, no. 5, May 1960, p. 444-448.

8792* The Determination of Tantalum and Tungsten in Rocks and Meteorites by Neutron Activation Analysis. Radiochemical separation from the components of the irradiated sample was employed to provide sources for measuring ^{182}Ta and ^{187}W by beta and gamma counting and by gamma spectrometry. Determinations of Ta at the lower limit of 8.10^{-10} g and W at 2.10^{-9} g have been made. ***D. H. F. Atkins and A. A. Smales.*** *Analytica Chimica Acta,* v. 22, no. 5, May 1960, p. 462-478.

8793 Potentiometric Behavior of a Silver-Plated Platinum Microelectrode Pair. Two microelectrodes of different sizes can be used to produce a derivative-type peak suitable for detection of the equivalence point in an iodide titration. Although the size of the smaller electrode was such that instrument-induced polarization could occur, the peak was shown to be due to differences in stress corrosion at the two electrodes. ***Raymond B. Hanselman, George H. Schade, Jr., and L. B. Rogers.*** *Analytical Chemistry,* v. 32, June 1960, p. 761-763.

8794 Gas Chromatographic Analysis of Nitriles. An attempt was made to resolve a mixture of close-boiling nitriles by gas chromatography. During the experimental part of this work, it was observed that the order of elution of nitriles on a nonpolar column is different from that on a polar one, and this phenomenon formed a basis for the technique described. ***Ihor Lysyj.*** *Analytical Chemistry,* v. 32, June 1960, p. 771.

8795 Fractional Thermogravimetric Analysis. In thermogravimetric analysis, measurements are made of weight loss due to the escape of all volatile matter from a sample during heating. The new technique, "fractional thermogravimetric analysis," extends the scope of thermogravimetric analysis by providing information on the compoistion or properties of the volatile matter. ***P. L. Waters.*** *Analytical Chemistry,* v. 32, June 1960, p. 852-858.

8796 Spectrophotometric Determination of Betaines and Other Quaternary Nitrogen Compounds as Their Periodides. *Joseph S. Wall, Donald D. Christianson, Robert J. Dimler, and Frederic R. Senti.* *Analytical Chemistry,* v. 32, June 1960, p. 870-874.

8797* A Micro-Determination of Carbohydrates and Proteins. ***G. Halliwell.*** *Biochemical Journal,* v. 74, no. 3, Mar. 1960, p. 457-462.

8798* Chromatographic Determination of Metal Impurities (Cu, Fe, Ni, Co) in Zinc and Zinc Salts. Concentrations of 0.0005% of the above metals can be determined by co-precipitation followed by paper chromatographic separation, and photodensitometric, colorimetric and polarographic analysis. A specific case of co-precipitation is studied by radiometric measurements, in the presence of ^{60}Co tracer. (*In Italian.*) Determinazione cromatografica di impurezze metalliche Cu, Fe, Ni, Co nello zinco e nei suoi sali. ***Ignazio Renato Bellobono.*** *Chimica e l'Industria,* v. 42, Mar. 1960, p. 259-262.

8799* Gasometric Determinations of Some Organic Nitrogenous Functions and More Generally of Compounds Able to Liberate a Quantitative Gas Volume. Description of a simple device easily assembled in any analytical laboratory and of methods of rapid and precise determinations of certain organic functions. The compounds involved in such determinations possess N in the diazo form, or N that can be reduced to this form. (*In French.*) Dosages gazométriques de certaines fonctions azotées organiques et, plus généralement, des composés pouvant donner lieu á une libération quantitative d'un volume gazeux. ***L. Nicolas and J. Mansel.*** *Chimie Analytique,* v. 42, Apr. 1960, p. 171-180.

8800 Analysis of Phenols by Gas Chromatography. A large number of simple C_6-C_9 phenols have been analyzed by gas chromatography. The xylenols have been studied in more detail in order to interpret the influence of alkyl groups on the retention volumes, and their relation with the constitution of this series of phenol. ***A. Kreyenbuhl and H. Weiss.*** *Coal Tar Research Association, Report No.* 0250, Feb. 25, 1960, 18 pp. (TP953 C63 Contin.)

8801 Determination by Neutron Activation of the Uranium-235 Concentration in Uranium Oxides. A nondestructive method of measuring the U-235 content is described. It is based on an over-all measurement of the short-lived fission product activity formed during a 15 sec neutron irradiation. (*In French.*) Determination par activation neutronique de la concentration d'uranium-235 dans des oxydes d'urane. ***S. May and P. Leveque.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1217, 1959, 6 pp. (QC770 F84.2r Contin.)

8802 Determination of Tracer Quantities of Chromium in Uranium. A method is described for the photometric determination of Cr in U by absorbency at 540 mμ of the Cr(VI) diphenylcarbazide combination. (*In French.*) Dosage de traces de chrome dans l'uranium. ***A. Huart.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1230, 1959, 19 pp. (QC770 F84.2r Contin.)

8803 The Determination of Submicrogram Quantities of Plutonium 239. Plutonium fluoride and lanthanum fluoride are co-precipitated and mounted on a stainless steel disk. The precipitate is then α-counted. ***G. J. Hunter and R. B. Chenley.*** *Great Britain, Atomic Energy Research Establishment,* A.E.R.E.-AM 19, 1959, 5 pp. (UF767 G79.1a Contin.)

8804 The Determination of Copper in Beryllium Compounds (Fluoride, Hydroxide and Ammonium Fluorberyllate). Solutions of the samples are fumed with sulfuric acid to remove fluoride and the residues are dissolved in water. After addition of citric acid and excess ammonia, ethylenediaminetetra-acetic acid is added followed by a solution of sodium diethyldithiocarbamate. The Cu is estimated absorptiometrically after extraction of the diethyldithiocarbamate complex into chloroform. ***J. Walkden.*** *Great Britain, Atomic Energy Research Establishment,* A.E.R.E.-AM 53, 1959, 3 pp. (UF767 G79.1a Contin.)

8805 The Determination of Chromium in Beryllium Compounds (Fluoride, Hydroxide, and Ammonium Fluorberyllate). ***J. Walkden.*** *Great Britain, Atomic Energy Research Establishment, A.E.R.E.-AM* 55, 1959, 3 pp. (UF767 G79.1a Contin.)

8806 The Separation of Neptunium and Plutonium by Ion Exchange. Plutonium and Np, after reduction to PuIII and NpIV by ammonium iodide in concentrated hydrochloric acid, can be separated on a Deacidite FF anion exchange column. The Np is eluted from the column by 2M HCl. Both elements were recovered in 100% yield. ***N. Jackson and J. F. Short.*** *Great Britain, Atomic Energy Research Establishment,* A.E.R.E.-M 444, 1959, 5 pp. (UF767 G79.1a Contin.)

8807* Detection and Determination of Tritium Labelled Compounds on Paper Chromatograms. Labelled compounds were detected, localized and the ratios of their activities determined precisely with a windowless scanner. The efficiency of counting tritium is low. The sensitivity limit lies around 3 mμc/cm^2 of Whatman No. 1 filter paper. ***P. A. Osinski.*** *International Journal of Applied Radiation and Isotopes,* v. 7, no. 4, Feb. 1960, p. 306-310.

8808 Colorimetric Reactions of Unsaturated Fatty Acids With Metal Salts. Esters and glycerides of oleic, linoleic and linolenic acids give colored products having characteristic absorption spectra when treated with ferric chloride or mercuric acetate in presence of glacial acetic acid and conc. H_2SO_4. These reactions provide the basis of a simple colorimetric method for the determination of these acids in some fats and oils. ***D. N. Rhodes.*** *Journal of Applied Chemistry,* v. 10, pt. 3, Mar. 1960, p. 122-124.

8809* Possible Use of Oxine N-Oxide as an Analytical Reagent. Oxine N-oxide forms with uranium^{6+} a yellowish red, water-soluble complex. The characteristics of the complex have been studied spectrophotometrically, and its molar composition and stability constant have been determined. ***A. N. Bhat and B. D. Jain.*** *Journal of Scientific & Industrial Research,* v. 19B, Jan. 1960, p. 16-20.

8810* Paper Chromatographic Analysis of Acids (Horizontal Migration Method). VI. Separation & Identification of Amino Acid Mixtures. The paper chromatographic behavior of amino acids in the presence of halogen acids and salts has been studied. The R_f values of amino acids are influenced by the nature and concentration of the salt present in the solvent rather than in the solution to be chromatographed. The presence of salt prevents the streaking of arginine and lysine halogen acid salts and lowers the R_f values of amino acids at higher concentrations. ***V. K. Mohan Rao.*** *Journal of Scientific & Industrial Research,* v. 19B, Feb. 1960, p. 62-66.

8811* The Recovery of Rhenium and the Analysis of Its Alloys. The quantitative recovery of Re from analytical or other residues by conversion to ammonium perrhenate on ion exchange columns, followed by hydrogen reduction or thermal decomposition of ammonium hexaiodorhenate, is described. ***A. A. Woolf.*** *Journal of the Less-Common Metals,* v. 1, no. 6, Dec. 1959, p. 420-423.

8812* The Polarographic Behaviour of Derivatives of 2-Nitroselenophen. It has been proved that the derivatives of 2-nitroselenophen are reduced 20–30 mV more difficultly than the corresponding derivatives of 2-nitrofuran, and their reduction takes place approximately at the same potentials as those of the p-substituted derivatives of nitrobenzene. By using the polarographic method, the solubility of some derivatives of 2-nitroselenophen in water has been determined. (*In Russian.*) Poliarograficheskoe izuchenie proizvodnykh 2-nitroselenofena. ***Ia. Stradyn', S. Giller, Iu. Iur'ev, E. Zaĭtseva.*** *Latvijas PSR Zinātnu Akademijas Vestis,* 1960, no. 3, p. 85-92.

8813* Spectrographic Method for the Quantitative Determination of Gallium in Solutions. Ga was determined in hydrochloric solutions. The Scheibe-Rivas process was compared with the rotating graphite disc process. Bi was used as the internal standard. The Scheibe-Rivas process works with ± 10%, the other with ± 4.8% average error. The cleaning of the graphite discs used was described. (*In Hungarian.*) Oldatos spektrográfiai eljárás gallium mennyiségi meghatározására. ***Aurélné Újhidy.*** *Magyar Kémiai Folyóirat,* v. 66, no. 4, 1960, p. 132-134.

8814 The Analytical Chemistry of Hafnium. A complete review of separation and analysis methods for Hf and Zr. Both Hf and Zr can be precipitated as the hydrous oxides from neutral or basic solutions, but this does not give efficient separation from many other metals. A better separation method is by precipitation as the phosphates form strong mineral acid solution. The best volumetric method of analysis to date has been

the chelatometric methods. Relatively few satisfactory reagents have been proposed for the colorimetric estimation of Hf and Zr. A table is given which summarizes the color reagents which have been studied. The two most important new classes of extraction reagents are the fluorinated diketones and the alkyl phosphoric acids. Ion-exchange techniques have been used mostly to separate the two elements from one another, but studies are now being devoted to the separation from other metals. Indirect chemical methods have been described for the determination of hafnium-zirconium ratios. They involve the determination of the total of Hf and Zr by two independent chemical methods, one of which is invariably the weighing of a mixture of the pure ignited oxides and the other a gravimetric, volumetric, or spectrophotometric measurement. The positive identification of Hf by classical chemical procedures is complicated by the homologous chemical properties of Hf and Zr. The optical and X-ray spectra of these elements are not identical, and identification can be made by various spectroscopic techniques. X-ray and optical spectroscopy methods are described. Chemical methods of analysis for the Hf impurities, N, Ti, Fe, Cu, Al, W, O, and Zr are given. ***G. W. Goward and R. M. Jacobs.*** Paper from "The Metallurgy of Hafnium", p. 287-322, 1960. United States Atomic Energy Commission, Washington 25, D. C. (TN799.H5 Un3.1m)

8815* Methods for Polarographic Determination of Tin. Determination of Sn in ores and in Pb containing products. Operating instructions are reported for each process. (*In German.*) Methoden zur polarographischen Bestimmung von Zinn. ***Helmut Bastius and Rolf Lehmann.*** *Neue Hütte*, v. 5, Mar. 1960, p. 161-164.

8816* Two Years' Application of Spectrographic Analysis in a Steel Industry Laboratory. From the beginning of 1958, two spectrographic analysis instruments, each comprising a high dispersion prism equipped with a profiling slit, have provided for continuous control of production at S. A. des Forges de la Providence at Marchienne-au-Pont. This article emphasises the manner in which the various problems which have arisen during the introduction of these methods have been solved. (*In French.*) Deux années d'application de l'analyse spectrale rapide dans un laboratoire sidérurgique. ***J. Massinon and A. Daniëls.*** *Revue de Métallurgie*, v. 57, Mar. 1960, p. 239-246.

8817* Spectrographic Determination of Hf/Zr Ratios. With a single exposure it is possible to cover the concentration range of 100·Hf/Zr from 0·1 to 100. ***G. Rossi.*** *Spectrochimica Acta*, v. 16, nos. 1-2, Feb. 1960, p. 25-29.

8818* Characteristics of Pulsed Discharges for the Spectrochemical Analysis of Impurities in Brass. Using a spectrographic source unit delivering a wide range of spark-ignited, low-voltage, pulsed discharges to excite spectra from a brass-type alloy, correlations have been obtained between the spectral characteristics of analytical interest, and the electrical parameters, peak current, mean pulse current, pulse duration and wave-form, by which the discharge conditions can be specified. ***J. McK. Nobbs, D. A. Sinclair, and R. N. Whittem.*** *Spectrochimica Acta*, v. 16, no. 3, Apr. 1960, p. 320-334.

8819* Syntheses of Derivatives of Dithizone and Their Application to Analytical Chemistry. III. On di-α-Naphthylthiocarbazone. IV. Compatibility of di-α-Naphthylthiocarbazone to the Determination of Mercury and Copper. III-IV. ***Shinsuke Takei and Takio Kato.*** *Tôhoku University, Technology Reports*, v. 24, no. 1, 1959, p. 75-94.

8820 3,3′,4′,5,7-Pentahydroxyflavanone as a Reagent for Spectrophotometric Determination of Molybdenum in Steel. By an extraction process, all interfering metals except WC are removed. Procedure is applicable for determining Mo in all substances not containing W. ***Frank L. Chan and Ross W. Moshier.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 59-265, July 1959, 6 pp. (TL507 Un3.18t Contin.)

8821 Chromatographic Separation and Ultraviolet Analysis of Polyphenyls. Interest in the use of polyphenyl-based fluids as coolant-moderators for nuclear reactors is increasing. Quantitative identification of the radiolyzed fluids would be helpful in (1) establishing radiolysis damage mechanisms and (2) in finding optimum methods for reclaiming and purifying degraded coolant fluid. ***W. W. West.*** *U. S. Atomic Energy Commission, AECU-4699*, Jan. 11, 1960, 28 pp. (UF767 U3au Contin.)

8822 Photochemical Separation of Mercury Isotopes. A photochemical method used for the separation of mercury isotopes has been successfully applied to the enrichment of mercury-204 in natural mercury. Concurrently with the enrichment of the 204 isotope, there occurred enrichment, but to a lesser extent, of the 199 and 201 isotopes as anticipated from theory. ***R. E. Ewing.*** *U. S. Atomic Energy Commission, HW-63177*, Dec. 23, 1959, 22 pp. (UF767 Un3.1hw Contin.)

8823* Colorimetric Determination of Zirconium by Reaction With Arsenazo. III. The new method is conducted in 2N HCl, the optimal interval of concentration 5-30 of Zr in 50 ml. Characterized by high selectivity, the determination is not interfered with by the prevalent amounts of such elements as Al, more than 100 mg, Fe(III) 5 mg, Fe(II) 15 mg, Ti 10 mg, and Sn 20 mg. In this way, Zr can be determined in ores without any preliminary separation from the accompanying elements. (*In Russian.*) Kolorimetricheskoe opredelenie tsirkoniia po reaktsii s arsenazo. III. ***V. G. Goriushina and E. V. Romanova.*** *Zavodskaia Laboratoriia*, v. 26, no. 4, 1960, p. 415-418.

8824* Use of Organic Reagents in Inorganic Analysis. XII. Analytical Reactions of Aryloxy Fatty Acids. XIII. Determination of Thorium and Zirconium With Aryloxy Fatty Acids. ***Sachindra Kumar Datta.*** *Zeitschrift für Analytische Chemie*, v. 174, no. 2, 1960, p. 104-118.

8825* Elatography. A Special Kind of Paper Chromatography. The substances to be identified are reacted with a suitable compound on the paper either before or during the elution of the chromatogram. The main characteristic of the method is that there are always reaction products which are separated and identified. The distance traveled by the front of the mobile phase can be essentially shortened by this procedure. The result is a great economy of time. (*In German.*) Elatographie. Eine spezielle Art der Papierchromatographie. ***A. Becker.*** *Zeitschrift für Analytische Chemie*, v. 174, no. 3, 1960, p. 161-169.

8826* Analytical Application of 8-Mercaptoquinoline (Thiooxine) and Its Derivatives. X. The Relative Stability of Thiooxintes and the Influence of Complexing Agents on the Interaction of Thiooxine With Cations. A stability series for thiooxinates of 26 elements were established. Stability of thiooxinates were shown to depend not only on the metal–sulphur bond, but on the strength of the metal–nitrogen bond as well. (*In Russian.*) Analiticheskoe primenenie 8-merkaptokhinolina (tiooksina) i ego proizvodnykh. X. Otnositel'naia ustoichivost' tiooksinatov i vliianie kompleksoobrazuiushchikh veshchestv na vzaimodeistvie tiooksina s kationami. ***Iu. A. Bankovskii, A. F. Ievin'sh, and Z. E. Liepinia.*** *Zhurnal Analiticheskoĭ Khimīi*, v. 15, no. 1, Jan.-Feb. 1960, p. 4-9.

8827* Hydron II.—A New Indicator for the Complexometric Determination of Calcium in the Presence of Magnesium. A new indicator with the inner light filter is suggested for the complexometric determination of Ca in the presence of Mg, which is called hydron II. The determination of Ca hardness of weakly mineralized waters with the use of hydron II as indicator, is shown. (*In Russian.*) Gidron II.—Novyĭ indikator dlia kompleksonometricheskogo opredeleniia kal'tsiia v prisutstvii magniia. ***I. S. Mustafin and E. S. Kruchkova.*** *Zhurnal Analiticheskoĭ Khimīi*, v. 15, no. 1, Jan.-Feb. 1960, p. 20-23.

8828* New Reagent for the Luminescent Determination of Gallium. The influence of substitutes on the luminescene of the compounds of Ga with trihydroxyazo reagents obtained by combining resorcinol with diazo constituents of *o*-aminophenol and its substitutes. (*In Russian.*) O novom reaktive dlia liuminestsentnogo opredeleniia galliia. ***A. M. Lukin and E. A. Bozhevol'nov.*** *Zhurnal Analiticheskoĭ Khimīi*, v. 15, no. 1, Jan.-Feb. 1960, p. 43-48.

8829* On the Polarographic Reduction of Halogenates and Their Oxidation Potentials. A mechanism of the process of the ClO_3^-, BrO_3^-, and IO_3^- reduction is suggested on the dropping Hg electrode and Pt electrode on the basis of the investigation results. (*In Russian.*) O poliarograficheskom vosstanovlenii galogenatov i ikh okislitel'nykh potentsialakh. ***Z. B.***

Roshdestvenskaya and O. A. Songina. *Zhurnal Analiticheskoĭ Khimii*, v. 15, no. 2, Apr. 1960, p. 138-146.

8830* Rapid Methods for Spectrographic Analysis of Rare Elements. I. Analysis of Complex Mixtures of Rare Earths. A rapid method for complete analysis of complex mixtures of rare earths is based on the use of the homologous pairs in combination with the stage weakening of the spectrum. The method permits to simultaneously determine all the individual rare earths in the range of concentrations (0.1–2) – 100%, with the accuracy of ± 10–20% (relative). The method is 8–10 times more rapid than the other spectrographic methods. (*In Russian.*) Ekspressnye metody spektral'nogo analiza redkikh elementov. I. Analiz slozhnykh smeseĭ redkikh zemel'. ***V. A. Korneev.*** *Zhurnal Analiticheskoĭ Khimii*, v. 15, no. 2, Apr. 1960, p. 170-174.

8831* Determination of Free Boron in Boron Carbide, Boron Nitride and Alloys on Their Basis. A method is developed for determining free B in boron carbide and boron nitride. The method is based on oxidating free B with a mixture of perhydrol and nitric acid, while B, combined in carbide or nitride, is not oxidized. The determination of free B ends in the titration with alkali in the presence of invert sugar. (*In Russian.*) Opredelenie svobodnogo bora v karbide bora, nitride bora i splavakh na ikh osnove. ***E. E. Kotlyar and T. N. Nazarchuk.*** *Zhurnal Analiticheskoĭ Khimii*, v. 15, no. 2, Apr. 1960, p. 207-210.

8832* Investigation of the Constitution Diagram of the TiFe-V System. Thermal, microstructural and radiographic analyses were applied to the study of this quasibinary system, containing a ternary metallic compound TiFeV formed by peritectic reaction as well as a small region of solid solutions. (*In Russian.*) Issledovanie diagrammy sostoianiia sistemy TiFe-V. ***Bi Tsin-Khua and I. I. Kornilov.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 902-907.

8833* Acid Resistance and Method of Analysis of Nitrides of Titanium, Zirconium, Niobium and Tantalum. The solubility of these substances was studied in different acids and mixture under cold conditions and during heating, in alkaline solutions and in a mixture of alkali and hydrogen peroxide. Tantalum nitride and of a lesser degree zirconium nitride have a maximum resistance to the action of different solvents. (*In Russian.*) Kisloustoĭchivost i methody analiza nitridov titana, tsirkoniia, niobiia, tantala. ***O. I. Popova and G. T. Kabannik.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 930-934.

See also: **8844** (precipitation of ZnS); **9344** (analysis of lubricating oils); **9387** (analysis of Al corrosion products); **9443** (determination of H in Al alloys).

CHEMISTRY—INORGANIC AND GENERAL

8834 The Preparation of the Anhydrous Zirconium Trihalides. A new process for preparing pure, anhydrous zirconium trichloride, tribromide and triiodide is described. The appropriate tetrahalide vapor is mixed with H_2 at a pressure of 3-4 mm and passed through a glow discharge. The zirconium trihalide which is formed is subsequently freed from adsorbed or unreduced contaminants by heating *in vacuo*. ***I. E. Newnham and J. A. Watts.*** *American Chemical Society, Journal*, v. 82, May 5, 1960, p. 2113-2115.

8835 Annual Research Task Summary, 1959. II. Chemistry. Contains information on research tasks in the U. S. Army Research and Development Program. The tasks reported include those being carried out both in Army laboratories and under contracts. All fields of chemistry are covered in this volume. v. II. Unpaged. 1959. Office of the Chief of Research and Development, U. S. Department of the Army, Washington, D. C. (U393 Un3.1a)

8836* Some Studies in Inorganic Complexes. VI. Nickel(II) With 2-Picolylamine. Conductance measurements in nitrobenzene, nitromethane, methanol, and water, magnetic measurements, and visible spectrum were studied. ***G. J. Sutton.*** *Australian Journal of Chemistry*, v. 13, no. 1, Feb. 1960, p. 74-79.

8837 The Chemistry of Quadrivalent Germanium. VII. Further Studies of the Complexes Formed Between Germanium and Polyhydric Alcohols. ***D. A. Everest and J. C. Harrison.*** *Chemical Society, Journal*, 1960, Apr., p. 1745-1752.

8838 Substitution Reactions of Platinum(IV) Complexes. The Synthesis and Properties of *trans*-Dithiocyanato-bis-(ethylenediamine)platinum(IV) Salts. Substitution reactions of *trans*-$Pt(en)_2Cl_2^{2+}$ with several different reagents are reported. The properties and possible structure of this complex are discussed. ***R. C. Johnson and F. Basolo.*** *Journal of Inorganic and Nuclear Chemistry*, v. 13, nos. 1-2, Apr. 1960, p. 36-43.

8839 The Mechanism and Kinetics of the Dehydration of Calcium Hydrogen Phosphate Dihydrate. The dehydration of $CaHPO_4 \cdot 2H_2O$ in dry air, humid air, and at various pressures of N_2 was studied by means of thermogravimetric, differential thermal and X-ray diffraction methods. ***J. G. Rabatin, R. H. Gale, and A. E. Newkirk.*** *Journal of Physical Chemistry*, v. 64, Apr. 1960, p. 491-493.

8840* Radiation Chemistry of Aqueous Solutions of Inorganic Nitrogen Compounds. Combination of N in the presence of water under the effect of ionizing radiations, radiolysis of aqueous solutions of ammonia, hydrazine, hydroxylamine, radio-öxidation of nitrite in nitrate, radiolytic transformation in aqueous solutions of nitrate and nitric acid, nitrate and H yields, formation of N and nitrogen oxides, products of oxidation, radiolysis of nitric acid and mechanism of radiolitic reduction of the NO_3'-ion were studied. (*In Russian.*) Radiatsionnaia khimiia vodnykh rastvorov neorganicheskikh soedineniĭ azota. ***A. K. Pikaev.*** *Uspekhi Khimii*, v. 29, no. 4, Apr. 1960, p. 508-524.

8841* The Effect of Potassium Sulfate Additions on the Lability of Vanadium Pentoxide Oxygen. A study has been made of isotopic exchange between molecular oxygen and vanadium pentoxide, both pure and with potassium sulfate additions amounting to 0.5 *M* per mole vanadium pentoxide. The addition of potassium sulfate increases the lability of oxygen in vanadium pentoxide. Maximum activity is manifested by a compound of the composition $V_2O_5 \cdot 0 \cdot 5K_2SO_4$. The entire oxygen of the compound, both of the pentoxide and of the sulfate, participates in the exchange. (*In Russian.*) Vliianie dobavok sul'fata kaliia na podvizhnost' kisloroda piatiokisi vanadiia. ***L. A. Kasatkina, G. K. Boreskov, and P. N. Sokolov.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 2, Feb. 1960, p. 360-366.

8842* Hydroxyl Ammonium Perchlorate. NH_3OHClO_4 of 99.2% purity was synthesized. By means of visual-polythermal and thermographic methods, the thermal effects occurring during its thermal decomposition were shown. The temperature limits, within which two expressed exothermic effects and one endothermic effect take place, were determined. (*In Russian.*) Perkhlorat gidroksilammoniia. ***A. A. Zinov'ev and I. A. Zakharova.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 775-777.

8843* On the Capacity of Reaction of Complex Compounds of Monovalent Copper With Phosphorous Acid Esters. During the interaction of complex compounds of monohalide Cu with saturated phosphorous acid esters of the following type $[CuG \cdot P(OR)_3]_3$ with heterocyclic nitrogen-containing compounds, amines, triphenylarsine and saturated phosphorous esters there is a splitting of the trimeric complex compounds with formation of mixed complex compounds of the type $[CuG \cdot P(OR)_3 \cdot A]$ where *A* is the heterocycle, amine, arsine, or phosphite. (*In Russian.*) O reaktsionnoĭ sposobnosti kompleksnykh soedineniĭ odnovalentnoĭ medi s efirami fosforistoĭ kisloty. ***M. M. Azanovskaia and L. A. Davidovskaia.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 870-873.

8844* Reaction of Zinc Sulfate With Ammonia in an Aqueous Medium. The reaction depends upon the initial concentration and molecular relationships of the reacting substances. Two types of basic zinc sulfates are precipitated: $ZnSo_4 \cdot nZn(OH)_2 \cdot xH_2O$ and $ZnSo_4 \cdot nZn(OH)_2 \cdot sNH_3 \cdot xH_2O$, where the coefficients *n*, *s*, and *x* have different values. With $NH_3 \cdot ZnSo_4 = 1.5 - 2.0$ in the initial mixture up to a concentration of 0.35 mol/l of zinc sulfate in solution, Zn is practically found entirely in a precipitate of basic sulfates of the second type. (*In Russian.*) O vzaimodeĭstvii sernokislogo tsinka

s ammiakom v vodnoĭ srede. ***A. K. Kirakosian.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 5, no. 4, Apr. 1960, p. 953-959.

8845* Some Particular Features of the Vacuum-Thermal Production of Titanium Boride. This production according to the reaction, $2TiO_2 + B_4C + 3C \rightleftarrows 2TiB_2 + 4CO$, revealed the possibility of obtaining pure borides with a low content of impurities from the technical boron carbide and double oxide of Ti. (*In Russian.*) Nekotorye osobennosti vakuumno-termicheskogo polucheniia borida titana. ***V. F. Funke, S. I. Iubkovskii, and G. V. Samsonov.*** *Zhurnal Prikladnoĭ Khimii,* v. 33, no. 4, Apr. 1960, p. 831-835.

See also: **8736** (catalysis).

CHEMISTRY—ORGANIC

8846 Fluoroketones. I. Fluoroketones have been shown to be versatile intermediates for the synthesis of new fluorine-containing structures. Ketals of unusual thermal and chemical stability have been prepared by a novel base-promoted ketalization. ***Howard E. Simmons and Douglas W. Wiley.*** *American Chemical Society, Journal,* v. 82, May 5, 1960, p. 2288-2296.

8847* Recent Methods of Preparative Organic Chemistry III. II. Preparation of Esters, Amides and Anhydrides of Phosphoric Acid. The following new reactions are described: preparation of pyrophosphates with isocyanate via the carbamyl phosphates; reactions of ketene acylales to form unsymmetrical pyrophosphates; trichloro acetonitrile as an esterification agent for phosphoric acids and the preparation of geranyl phosphate and farnesyl phosphate; preparation and reaction mechanism of the imidazolides of phosphoric acid. (*In German.*) Neuere Methoden der präparativen organischen Chemie III. II. Darstellung von Estern, Amiden und Anhydriden der Phosphorsäure. ***F. Cramer.*** *Angewandte Chemie,* v. 72, nos. 7-8, Apr. 21, 1960, p. 236-249.

8848* Annotated Bibliography on the Use of Organolithium Compounds in Organic Synthesis. A supplement containing abstracts or papers which were published or became available during the year 1959. The main emphasis of the bibliography is the use of alkyl- and aryllithium compounds in Grignard-type reactions. However, the scope of the bibliography has been broadened to include abstracts of papers dealing with the use of Li metal as a reducing agent in ammonia and low molecular weight amines, reflecting current interest in this type reaction. Other applications of Li metal and Li compounds in organic synthesis are also included; for example, their use as catalysts or initiators in various polymerization procedures. ***Florence Emert, Robert W. Gibson, Jr., and Ralph L. Darby.*** Supplement No. 7. Unpaged. Jan. 1, 1960. Lithium Corporation of America, New York. (ZQD412.65 L71a Ref.)

8849* Coordination Compounds of Substituted 1,10-Phenanthrolines and Related Dipyridyls. I. Synthesis of 2,9-Dimethyl-1,10-Phenanthroline. Direct synthesis developed which involves a Skraup type of reaction between *o*-phenylenediamine, crotonaldehyde, and either arsenic(V) oxide or sodium *m*-nitrobenzenesulphonate. Some derivatives of 2,9-dimethyl-1,10-phenanthroline are characterized. ***E. J. O'Reilly and R. A. Plowman.*** *Australian Journal of Chemistry,* v. 13, no. 1, Feb. 1960, p. 145-149.

8850 Chemicals in Coal Tar. Describes the nature of the acids and bases found in tar and some of their uses as chemical intermediates. The hundreds of chemicals that have been isolated from tars range from the simple gas methane to complex compounds such as $C_{20}H_{16}$ or $C_{24}H_{12}$ with molecular weights in excess of 300. The majority of these individual chemicals are hydrocarbons but there are also materials containing O, S, and N. "Tar acids" are phenol and substituted phenols which form water-soluble sodium salts and can thus be separated from the other compounds in chemical oil. The structural formula, boiling point, melting point, and density data are given for many tar acids. "Tar bases" are nitrogen-containing structures that form water-soluble acid salts. They are isolated from chemical oil after the tar acids are extracted with caustic. Data is also given in tabular form for the bases. Tar acids are widely used in chemically unmodified forms in such fields as extractive solvents for petroleum refining, disinfectants, frothing agents for ore concentration, metal degreasing and carbon removal, and wire enamel solvents. Unmodified tar bases are employed as solvents, acid-acceptors, metal pickling inhibitors, denaturants for alcohol, and stabilizers for chlorinated solvents. The uses of tar components as phenolic resins, epoxy resins, antioxidants, germicides, antiseptics, fungicides, perfumes, flavoring, drugs, vitamins, plasticizers, dyes, and photographic developers are discussed in detail. ***C. K. M. Winne.*** Paper from "Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings", The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York. 1960, p. 266-292. (TN713 Am35p Vis.)

8851* Potassium Derivatives of Fluorene as Intermediates in the Preparation of C_9-Substituted Fluorenes. I. The Preparation of 9-Fluorenyl Potassium and the Infrared Spectra of Fluorene and Some C_9-Substituted Fluorenes. 9-Fluorenylpotassium and 9,9-fluorenyldipotassium have been prepared from the reaction of potassium metal with fluorene in dioxane. These organometallic compounds upon reaction with alkyl and aralkyl halides gave 9-substituted fluorenes. ***G. W. H. Scherf and R. K. Brown.*** *Canadian Journal of Chemistry,* v. 38, May 1960, p. 697-711.

8852 Chlorination, and Bromination, of Cyclic Acetals. Chlorination of *trans*-1,4,5,8-tetraoxadecalin yielded 2,3-dioxo-1,4-dioxan, in addition to di-2-chloroethyl oxalate. Interaction of the halogeno-esters with *p*-anisidine and with thiourea is described. ***L. A. Cort and Ronald G. Pearson.*** *Chemical Society, Journal,* 1960, Apr., p. 1682-1687.

8853 New Chloroethylaminoaryl Substituted Amino-Acids. Di-2-chloroethylaminoaryl substituted amino-acids are of considerable interest as very active tumor growth-inhibiting substances. This type of compound has been prepared by condensing a suitable nitro-aralkyl halide with an acylaminomalonic ester followed by reduction of the nitro-group, dihydroxyethylation and conversion into the di-2-chloroethylaminoaryl derivative. ***T. A. Connors and W. C. J. Ross.*** *Chemistry & Industry,* 1960, no. 18, Apr. 30, p. 492-493.

8854* Alkaline and Alkaline-Earth Acetylides and Carbides. Lithium acetylide with a molecule of combined ammonia; sodium potassium, rubidium and caesium ammonia-free acetylides and acetylides of alkaline earth metals, partially combined with ammonia, were isolated and identified. Lithium, sodium, and alkaline-earth metal carbides were obtained by decomposition of acetylides; the isolation of potassium carbide in the pure form is not possible. (*In Italian.*) Gli acetiluri ed i carburi alcalini ed alcalino-terrosi. ***M. Corbellini and L. Turner.*** *Chimica e l'Industria,* v. 42, Mar. 1960, p. 251-254.

8855* Synthesis of Chloro-2-Chromones, a New Method to Obtain Hydroxy-4 Coumarins. The action of very diluted soda on o-hydroxyketones prepared by Friess transposition of the aryl dichloracrylates causes a good yield of chloro-2 chromones unknown before. The hydrolysis of these compounds is a new way to prepare hydroxy-4 coumarins. (*In French.*) Synthèse des chloro-2 chromones, nouvelle voie d'accès aux hydroxy-4 coumarines. ***Marcelle Levas and Émile Levas.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 250, no. 16, Apr. 20, 1960, p. 2819-2821.

8856 The Radiolysis of Liquid Methyl Acetate With Co^{60} Gamma Radiation. Irradiation of air-free liquid methyl acetate at ambient temperatures yields six gaseous and 17 liquid products. All the bonds in methyl acetate except the carbonyl double bond appear to be broken. The effects of "radical scavengers" on gas yields are examined. ***R. W. Hummel.*** *Faraday Society, Transactions,* v. 56, Feb. 1960, p. 234-245.

8857 Synthesis of Organic Substances Labelled With ^{14}C and ^{35}S. After a brief history of the development of the "Section des Molecules Marques" of the French Atomic Energy Commission, an outline of the synthesis of the following labeled compounds is given: benzene ^{14}C-6; phenyl, *p*-fluorophenyl, thienyl-2 β alamines β ^{14}C; noradrenaline β ^{14}C (arterenol β ^{14}C), dotriacontane ^{14}C-16-17, aminoethane sulfinic acid (hypotaurine ^{35}S). (*In French.*) Synthèses de molécules organiques marquées par le carbone-14 et le soufre-35. ***L. Pichat.*** *France,*

Commissariat a l'Énergie Atomique, Rapport CEA No. 1015, 1958, 12 pp. (QC770 F84.2r Contin.)

8858 Ion Exchange Resins From Lignite Coal. Because of its low cost, unlimited supply, and some natural ion exchange properties, lignite coal is promising as an organic base for making ion exchangers. The original capacity could be increased by both heat treatment and sulfonation with sulfuric acid. Heat treatment for one hour at 100 to 110 C, followed by sulfonation for eight hours produced the best ion exchanger. ***Donald S. Seitz, F. L. Minnear, and R. E. Dunbar.*** *Industrial and Engineering Chemistry,* v. 52, Apr. 1960, p. 313-314.

8859 Formation of Lactic Acid by Alkaline Decomposition of Sucrose in the Presence of Salts of the Alkaline Earths. ***C. Boelhouwer, D. Korf, and H. I. Waterman.*** *Journal of Applied Chemistry,* v. 10, pt. 3, Mar. 1960, p. 113-115.

8860 Oxidation of Monoethenoid Fatty Acids and Esters: Catalytic Oxidation of Ethylene Glycol Dielaidate. The preparation and properties of highly purified ethylene glycol dielaidate is described and a study of its union with gaseous oxygen at 55°, 85°, and 120° was made. ***K. E. Andrews and J. H. Skellon.*** *Journal of Applied Chemistry,* v. 10, pt. 4, Apr. 1960, p. 176-181.

8861 Use of Metal Complexes in Organic Dyes and Pigments. The historical, theoretical, and commercial aspects of the use being made of metal complexes in man-made organic dyes and pigments, touching only briefly on metal complexes or lakes made from natural coloring products, are summarized. ***O. Stallmann.*** *Journal of Chemical Education,* v. 37, May 1960, p. 220-230.

8862 Cyclic Acrolein Acetals. Acetals were made in 70-98% yields by reaction of acrolein and various alcohols, largely 1,2- and 1,3-glycols. β-Chloro-, hydroxy-, cyano, and α,β-epoxy-derivatives otherwise difficultly accessible are readily prepared from the acetals derived from 2-methyl-2,4-pentanediol or pentaerythritol. ***R. F. Fischer and C. W. Smith.*** *Journal of Organic Chemistry,* v. 25, Mar. 1960, p. 319-324.

8863 Guanamines. III. Perfluoroalkylguanamines and Related Compounds. Guanamines were synthesized for pharmacological evaluation. ***Seymour L. Shapiro, Vincent A. Parrino, and Louis Freedman.*** *Journal of Organic Chemistry,* v. 25, Mar. 1960, p. 379-384.

8864 Reactions of Nitroalkanes With Olefin Oxides. Acidic mononitroalkanes react with olefin oxides in the presence of pyridine. The products depend upon the nature of the nitroalkane. ***Melvin J. Astle and Frank J. Donat.*** *Journal of Organic Chemistry,* v. 25, Apr. 1960, p. 507-511.

8865 Ketals of Monohydric Secondary Alcohols. Alkoxyl interchange between secondary alcohols and simple ketals gives ketals containing secondary alkoxyl groups in good yields. ***W. L. Howard and N. B. Lorette.*** *Journal of Organic Chemistry,* v. 25, Apr. 1960, p. 525-530.

8866 Addition of Silylmetallic Compounds to Olefins. Triphenylsilylpotassium and triphenylsilyllithium have been found to add to the olefinic linkage of 1,1-diphenylethylene and of triphenylethylene. No addition occurred, under corresponding conditions, to tetraphenylethylene and to a variety of aliphatic and alicyclic olefins. ***T. C. Wu, Dietmar Wittenberg, and Henry Gilman.*** *Journal of Organic Chemistry,* v. 25, Apr. 1960, p. 596-598.

8867 Catalytic Oxidation of Hydrocarbons. Initiation by Ozone. The isomeric xylenes are readily oxidized to the respective toluic acids with oxygen in acetic acid solvent at reflux temperature. The reaction is catalyzed by cobalt ion and initiated by ozone. ***Allan S. Hay, John W. Eustance, and Harry S. Blanchard.*** *Journal of Organic Chemistry,* v. 25, Apr. 1960, p. 616-617.

8868 Pyrolysis of Silver *o*-Halobenzoates. Silver *o*-chlorobenzoate pyrolyzed smoothly above its melting point to give phenyl *o*-chlorobenzoate, silver chloride, and carbon dioxide. Evidence is presented suggesting that benzyne, C_6H_4, may be an intermediate in the formation of the phenyl ester. ***Howard E. Simmons.*** *Journal of Organic Chemistry,* v. 25, May 1960, p. 691-693.

8869 Cyanoethylation. I. The Selective Cyanoethylation of 2-Aminoethanethiol Hydrochloride. Over the *p*H range of 3.2 to 6.9 aqueous solutions of 2-aminoethanethiol hydrochloride react with acrylonitrile exclusively on the sulfhydryl group to give good yields of 3-(2-aminoethylthio) propionitrile hydrochloride. In basic solutions a rapid and nonselective reaction is observed. ***Richard J. Gaul, Winfried J. Fremuth, and Michael N. O'Connor.*** *Journal of Organic Chemistry,* v. 25, May 1960, p. 725-726.

8870 *N*-Substituted Glycinate and Alaninate Esters. *N*-substituted glycinate and α- and β-alaninate esters were prepared as possible antimetabolites for the control of *Fusarium* wilt diseases. Some qualitative results are presented on the relative ease of displacement of the α-halogen atom and aminolysis of the ester group in the reaction of haloacetate esters with primary aliphatic amines. ***A. J. Seziale and E. G. Jaworski.*** *Journal of Organic Chemistry,* v. 25, May 1960, p. 728-732.

8871 Synthesis of Monomeric Silanes. The preparations of 4-trimethylsilylstyrene and of 4-epoxyethylphenyltrimethylsilane are described, as well as attempts to extend these reactions to the preparation of the analogous difunctional monomers. ***Allen E. Senear, Joseph Wirth, and Roy G. Neville.*** *Journal of Organic Chemistry,* v. 25, May 1960, p. 807-809.

8872* Ultraviolet Absorption Spectra of Substituted Acetylenes. It has been shown that the long wavelength transition in phenylacetylene involves principally phenyl vibrations, whereas in diphenylacetylene it is the acetylenic vibrations that are excited. ***M. R. Padhye and B. Seshagiri Rao.*** *Journal of Scientific & Industrial Research,* v. 19B, Jan. 1960, p. 1-4.

8873* Spectral Studies of Halogenated Benzaldehydes. I. Vibrational Spectra of *ortho*-, *meta*-, & *para*-Chlorobenzaldehydes. The infrared spectra of *o*-, *m*-, and *p*-chlorobenzaldehydes were recorded in the region 2-15 μ. Most of the frequencies are assigned to different vibrational modes, and are correlated with those of benzaldehyde and benzene. ***M. R. Padhye and B. G. Viladkar.*** *Journal of Scientific & Industrial Research,* v. 19B, Feb. 1960, p. 45-49.

8874 Studies of the Structure, Thermal Expansion and Molecular Vibrations of Di-*p*-xylylene, $C_{16}H_{16}$, at 93 and 291 K. ***Kathleen Lonsdale, H. Judith Milledge, and K. V. Krishna Rao.*** *Royal Society, Proceedings,* v. 255, ser. A, Mar. 22, 1960, p. 82-100 + 1 plate.

8875* Molecular Structure and Estrogenic Activity. I. Unsymmetrical Diphenylethylenes and Triphenylethylenes. Variation in the planarity of estrogenic substituted ethylenes has been studied by means of U.V. absorption. ***J. F. Miquel.*** *Tetrahedron,* v. 8, nos. 3-4, Mar. 1960, p. 205-216.

8876* Organic Reactions in Strong Alkalies. I. Fission of Ethylenic Acids (The Varrentrapp Reaction). II. Fission of Di-Ethylenic and Acetylenic Acids. III. Fission of Keto- and Hydroxy-Acids. I. ***R. G. Ackman, Patrick Linstead, B. J. Wakefield, and B. C. L. Weedon.*** II. ***R. G. Ackman, R. A. Dytham, B. J. Wakefield, and B. C. L. Weedon.*** III. ***R. A. Dytham and B. C. L. Weedon.*** *Tetrahedron,* v. 8, nos. 3-4, Mar. 1960, p. 221-260.

8877* The Reaction of 2,4-Dinitrobenzenesulphenyl Chloride With Organic Monosulphides. 2,4-Dinitrobenzenesulphenyl chloride reacts with dialkyl, diaralkyl, and alkyl aralkyl monosulphides at ca. 20° in dry acetic acid to give alkyl or aralkyl 2,4-dinitrophenyl disulfides together with alkyl or aralkyl chlorides as major products. The reactivity order with respect to the constitution of the sulfide is: tertiary alkyl > benzyl > secondary alkyl > primary alkyl. With unsymmetrical sulfides, the more branched alkyl group is displaced by the 2,4-dinitrophenylthio group. ***C. G. Moore and M. Porter.*** *Tetrahedron,* v. 9, nos. 1-2, Apr. 1960, p. 58-64.

8878* Carcinogenesis by Thiophene Isosters of Polycyclic Hydrocarbons. Synthesis of Condensed Thiophenes. ***B. D. Tilak.*** *Tetrahedron,* v. 9, nos. 1-2, Apr. 1960, p. 76-95.

8879* Novel Synthesis of Organo- Tri- and Di-Fluorosilanes With Aqueous Hydrofluoric Acid. Conversion of organo- tri- and di-chlorosilanes to their fluoro-analogs in excellent yields via reaction with aqueous 48% hydrofluoric acid.

Leonard Spialter, Russell S. Towers, and Millard M. Kent. *Tetrahedron Letters*, 1960, no. 5, Mar., p. 11-14.

8880* Diborane Reduction of Carboxyl Groups in Carbonhydrates. The successful transformation of the -COOH group to $-CH_2OH$ not only in monosaccharide acids but also in acidic polysaccharides is reported. Preliminary experiments indicate that diborane reduction of acidic carbohydrates is a general reaction and that the production of neutral polysaccharides from acid polysaccharides such as pectic substances, acidic hemicelluloses, plant gums and mucilages is within the scope of the reaction. The new method also opens up the possibility of producing certain sugars and their derivatives by a more direct route than has hitherto been available. ***F. Smith and A. M. Stephen.*** *Tetrahedron Letters*, 1960, no. 7, Apr., p. 17-23.

8881* Mechanisms of Some Reactions With the Participation of Peroxides. Oxidation of ketones and aldehydes by means of per acids and peroxides of H, regrouping of 9-decalilperbenzoate, hydrolysis of per acids and the reaction of H peroxide with alcohols, thermal decomposition of the peroxides, the cellular effect, oxidation of phenols and olefins were studied. (*In Russian.*) Mekhanizmy nekotorykh reaktsiĭ s uchastiem perekiseĭ. ***Ia. K. Syrkin and I. I. Mouseer.*** *Uspekhi Khimii*, v. 29, no. 4, Apr. 1960, p. 425-469.

8882* Reaction of Aromatic Diamines With Urea and Its Thio-Derivatives. When in the reaction of hexamethylenediamine with urea the former is replaced by *p*- and *m*-phenylenediamines, i. e. by diamines having the same number of carbon atmos but a cyclic structure, polymers are produced in the form of non-fusible powders of poor solubility in organic solvents. They are readily soluble in sulfuric acid and somewhat less in pyridine. (*In Russian.*) O vzaimodeĭstvii aromaticheskikh diaminov s mochevinoĭ i ee tioproizvodnymi. ***V. D. Yasnopolskiĭ and E. A. Krasnoselskaya.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 3, Mar. 1960, p. 441-443.

8883* The Effect of Substituents on the Properties of Aromatic Nitriles and Sulfones. A study has been made of the Raman spectra, ultraviolet absorption spectra and dipole moments of the para substituents of benzonitrile and methylphenylsulfone. The sequences of the para substituents arranged in the order of their influence on the dipole moments (as well as on the absorption and Raman spectra) of aromatic nitro compounds, ketones, nitriles and sulfones are approximately the same. In this respect the sulfones do not differ in principle from the nitro compounds and sulfones. However, the effect of the substituents is considerably weaker in the sulfones. (*In Russian.*) Vliianie zamestiteleĭ na svoĭstva aromaticheskikh nitrilov i sul'fonov. ***P. P. Shorygin, M. A. Geiderikh, and T. I. Ambrush.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 2, Feb. 1960, p. 335-342.

CHEMISTRY—PHYSICAL

8884* Physico-Chemical Principles of Titanium Metallurgy. The technical processes used at present for the recovery of Ti are outlined; thermochemical data of the titanium halogenides and of the system Ti/O are screened and newly evaluated, and possible approaches to Ti production and raffination on the basis of these data are discussed. (*In German.*) Physikalisch-chemische Grundlagen zur Titan-Metallurgie. ***O. Kubaschewski.*** *Angewandte Chemie*, v. 72, nos. 7-8, Apr. 21, 1960, p. 255-263.

8885* On the Formation of Pyrazoles From Thiohydrazides and α-Halogencarbonyl Compounds. II. 5,6-Diphenylthiadiazines and 4,5-Diphenylpyrazoles. ***Jan Sandström.*** *Arkiv för Kemi*, v. 15, no. 3, 1960, p. 195-210.

8886* Acid-Induced Aromatic Hydrogen Exchange. II. Determination of the Solubility of Benzene and Toluene in Aqueous Sulphuric Acid. Influence of Isotopic Mass of Hydrogen on the Solubility. IV. Determination of the Exchange Rates of Deuterium and Tritium Against Protium in Thiophene. Kinetic Isotope Effect in the Isotopic Exchange. II. ***Stig Olsson.*** IV. ***Börje Östman and Stig Olsson.*** *Arkiv för Kemi*, v. 15, no. 3, 1960, p. 259-282.

8887* The Energy of Hydrogen Bonding in the System: Acetone-Chloroform. It is shown that acetone and chloroform form a compound stable in the solid state, whereas acetone and carbon tetrachloride do not form a compound. The enthalpies of mixing of acetone and chloroform of acetone and carbon tetrachloride have been determined. ***A. N. Campbell and E. M. Kartzmark.*** *Canadian Journal of Chemistry*, v. 38, May 1960, p. 652-655.

8888 Thermal Stability and Solution Properties of Copper Nitrate—Dinitrogen Tetroxide. The preparation of the addition compound $Cu(NO_3)_2$, N_2O_4 from Cu in organic solvent–dinitrogen tetroxide mixtures is described. ***C. C. Addison and B. J. Hathaway.*** *Chemical Society, Journal*, 1960, Apr., p. 1468-1474.

8889* Thermal Conductivity of Hydrocarbons. Two methods for determining the thermal conductivity of gases and liquids are described. The first of these, the hot wire method, was used to measure the thermal conductivity of several gaseous hydrocarbons. For liquids, it was found that the cylinder method with a fine measuring gap is more suitable. ***O. Vilím.*** *Collection of Czechoslovak Chemical Communications*, v. 25, no. 4, Apr. 1960, p. 993-999.

8890 Some Properties of Aluminum Nitride. Aluminum nitride crystals in the form of six-sided prismatic needles, up to 0.5 mm in diameter by 30 mm long, and thin plates, 2-3 mm in diameter, were prepared by vaporization of Al in a N_2 atmosphere at temperatures ranging from about 1800 to 2000 C. Properties of the crystals were determined. ***K. M. Taylor and Camille Lenie.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 308-314.

8891 The Viscosity of Some Fluorocarbons in the Vapour Phase. Measurements were made of the temperature coefficients of viscosity of the vapors of tetrafluoro-ethylene, hexafluoroethane, perfluoro-n-pentane and perfluoro-n-hexane. For all of these vapors, the temperature coefficients of viscosity are smaller than those for the corresponding hydrocarbons. This was interpreted in terms of the intermolecular forces between fluorocarbon molecules which change steeply with the distance between molecular centers. ***J. C. McCoubrey and Narinder Mohan Singh.*** *Faraday Society, Transactions*, v. 56, Apr. 1960, p. 486-489.

8892 Heats of Chemisorption of CO_2, CO, and H_2 on Zinc Oxides With and Without Valency Induction. Adsorption isotherms of CO_2, CO, and H_2 on pure zinc oxide, zinc oxide containing 0·5 mole % Ga_2O_3 and zinc oxide containing 0·5 mole % Li_2O were measured in the temperature range 250 to 320 C and below a pressure of 1 mm Hg. The quasi-free electron concentration in the adsorbents was found to influence the heats of adsorption considerably, especially at low coverages. ***P. M. G. Hart and F. Sebba.*** *Faraday Society, Transactions*, v. 56, Apr. 1960, p. 551-556.

8893 Adsorptive Properties of Polymer Carbons. I. Comparative Data. II. Determination of Pore Sizes. The adsorptive capacities for water and a number of organic substances shown by a range of polymer carbons is compared with those of polyvinylidene chloride (Saran) carbon and a typical coconutshell charcoal. The results are considered in terms of the processess thought to occur during the carbonization of simple polymers. ***J. J. Kipling and R. B. Wilson.*** *Faraday Society, Transactions*, v. 56, Apr. 1960, p. 557-569.

8894 Extraction of Sulphates by Long Chain Amines. The extraction of sulfuric acid by long chain amines in organic solution was studied to determine the value of the stability constants of the amine sulfates and bisulfates formed. (*In French.*) Extraction des sulfates par les amines à longues chaines. ***Christiane Boirie.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1262, 1960, 59 pp. (QC770 F84.2r Contin.)

8895 Solubility of Hydrogen Halides in Organic Compounds Containing Oxygen. V. Solubility of Hydrogen Chloride and Bromide in Some Esters and Ethers and Vapour Pressures of Hydrogen Chloride in Certain Solutions. ***W. Gerrard, A. M. A. Mincer, and P. L. Wyvill.*** *Journal of Applied Chemistry*, v. 10, pt. 3, Mar. 1960, p. 115-121.

8896 Kinetics of $NouF_6$ Hydrolysis in Air. The kinetics of $NouF_6$ hydrolysis has been determined from 68 to 231 C. The results indicate that the hydrolysis reaction follows parabolic kinetics throughout. ***F. E. Massoth, L. R. Swaney, and W. E. Hensel, Jr.*** *Journal of Physical Chemistry*, v. 64, Apr. 1960, p. 414-417.

8897 The Dielectric Properties of Mercuric Chloride and Mercuric Bromide in Dioxane. Dielectric constant measurements on mercuric chloride and mercuric bromide in dioxane yield dipole moment values for the two halides comparable with those obtained in benzene indicating that dioxane behaves in this case as an inert solvent. The enthalpy of activation for dipole relaxation of the two compounds in dioxane are approximately 3.1 and 3.4 kcal., respectively. ***A. R. Tourky, H. A. Rizk, and Y. M. Girgis.*** *Journal of Physical Chemistry*, v. 64, May 1960, p. 565-567.

8898 Kinetics and Mechanism of the Air Oxidation of the Dithionite Ion ($S_2O_4^=$) in Aqueous Solution. Under conditions in which diffusion of air was not controlling it was found that the oxidation was half order with respect to dithionite and first order with respect to molecular oxygen. The half order mechanism was attributable to the presence of the SO_2^- radical ion as an intermediate. ***Robert G. Rinker, Thomas P. Gordon, David M. Mason, Roy R. Sakaida, and William H. Corcoran.*** *Journal of Physical Chemistry*, v. 64, May 1960, p. 573-581.

8899 Thermodynamic Properties of Higher Fluorides. I. The Heat Capacity, Entropy, and Heats of Transition of Molybdenum Hexafluoride and Niobium Pentafluoride. II. The Heats of Solution and of Formation of Molybdenum Hexafluoride, Tungsten Hexafluoride and Niobium Pentafluoride. I. ***A. P. Brady, O. E. Myers, and J. K. Clauss.*** II. ***O. E. Myers and A. P. Brady.*** *Journal of Physical Chemistry*, v. 64, May 1960, p. 588-594.

8900 Kinetics of the Gas Phase Oxidation of Hydrogen Chloride and of Hydrogen Bromide by Nitrogen Dioxide. The oxidations of HCl and of HBr by NO_2 have been studied in the temperature range from 100 to 420°. The rate of reaction varies with the reactant concentrations. Reaction mechanisms are proposed. ***Willis R. Rosser, Jr. and Henry Wise.*** *Journal of Physical Chemistry*, v. 64, May 1960, p. 602-604.

8901 Selective Liquid Adsorption With Alkali Metals on Active Carbon. To determine the liquid-adsorption characteristics of active carbons, percolation and batch-contacting techniques were applied to a study of the adsorption of toluene and of di-*n*-propyl sulfide from *n*-heptane. ***W. F. Wolff, Philip Hill, and G. D. McLeod.*** *Journal of Physical Chemistry*, v. 64, May 1960, p. 646-649.

8902* Study of the Dielectric Behaviour of Liquid Mixtures. I. *n*-Octyl Alcohol-diethylene Glycol & *n*-Propyl Alcohol-glycerol Mixtures. The dielectric behavior of two liquid mixtures, *n*-octyl alcohol-diethylene glycol and *n*-propyl alcohol-glycerol, has been investigated in the ultra-high frequency region using the standing wave method of Roberts and Von Hippel. ***V. Sarojini.*** *Journal of Scientific & Industrial Research*, v. 19B, Feb. 1960, p. 52-54.

8903* The Heat and Entropy of Adsorption of Benzene and N-Hexane Vapors on Magnesium Hydroxide. Adsorption isotherms on magnesium hydroxide at two temperatures the differential heat and entropy curves of adsorption of benzene and n-hexane vapors. Standard heat of adsorption of benzene vapor on magnesium hydroxide is greater than that for n-hexane vapor. (*In Russian.*) Teplota i entropiia absorbtsii parov benzola i N. geksana na gidrookisi magniia. ***A. V. Kiselev and D. P. Poshkus.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 1, Jan.-Feb. 1960, p. 25-30.

8904* Effects of Temperature on the Oxidation of Iron in Solutions of Single Phosphate of Potassium. The oxidation was studied between 20 and 90 C under static conditions, the metal plates being fully immerged in a 2.0 N solution and in solutions of higher concentrations. The pH value of the solutions increases the first three days and then remains stable, depending closely on the salt concentration. In 2.0-1.0 N solutions, the pH value is about 5; in 0.001 N solutions, 7 to 8. (*In Russian.*) O vlianii temperatury na okislenie zheleza v rastvorakh odnozameshchennogo fosfata kaliia. ***A. Lokenbakh and L. Lepin'.*** *Latvijas PSR Zinātnu Akademijas Vestis*, 1960, no. 3, p. 107-112.

8905 Thermodynamic Properties of Hafnium and Its Compounds. The thermodynamics are discussed for the metal, dioxide, nitride, carbide, and four tetrahalides. ***K. K. Kelley and E. G. King.*** Paper from "The Metallurgy of Hafnium", p. 323-356, 1960. United States Atomic Energy Commission, Washington 25, D. C. (TN799.H5 Un3.1m)

8906 Modern Coordination Chemistry. Principles and Methods. The thermodynamics, reaction rates, isomerism, visible, ultraviolet and infrared spectra, and magnetochemistry of metal complexes and of complex compounds are reported. ***J. Lewis and R. G. Wilkins, editors.*** 487 pp. 1960. Interscience Publishers, New York. (QD471 L58m)

8907* The Influence of the Electrolyte and Solvent on the Ion Activity. Both potentiometric and kinetic measurements can give values of log γ, the activity coefficient of HCl for $m \rightarrow 0$ in water-ethanol mixtures with various portions x_{et}. An electrostatic relation is applied to the log γ values and to the 2 *Bm* term of the Debye-Hückel formula. The dependence of the ionic activity of *m* can be expressed, taking into account the change of the dielectric constant with *m*. (*In Swedish.*) Om inverkan av elektrolyt och lösningsmedel på jonaktiviteten. ***Sulo Kilpi.*** *Svensk Kemisk Tidskrift*, v. 72, no. 3, 1960, p. 178 + 9 pages.

8908* Carbon-Carbon Bond Energies. Although it is difficult to arrive at entirely reliable and precise values for bond energies of the various types of carbon-carbon bonds, it is possible to estimate probable relative values. This is done without involving the heats of sublimation of diamond or graphite, but the requirement still outstanding is an unequivocal value for any one bond of known order. ***J. C. Earl.*** *Tetrahedron*, v. 9, nos. 1-2, Apr. 1960, p. 65-66.

8909* Nonlinear Ferro-Electric Systems With Various Curie Temperatures. It is possible to obtain ferro-electric systems with various Curie temperatures in ternary systems on a $Ba(Ti, Sn, Zn)O_3$ base. Depending on the procedure and conditions of quenching, it is possible to obtain various properties of this system and to influence the Curie temperature to a very great extent. The basic characteristics of ternary systems on a Ba $(Ti_{0.75}, Sn_{0.1}, Zr_{0.15})O_3$ base are given. (*In Ukrainian.*) Nelinīini segnetoelektrychni systemy z riznoiu temperaturoiu Kiuri. ***M. M. Nekrasov and Y. D. Kobtser.*** *Ukrains'kyi Fizichnyi Zhurnal*, v. 5, no. 1, Jan.-Feb. 1960, p. 75-78.

8910 A Kinetic Study of the Thermal Decomposition of Tetraphenylsilane, Triphenylphosphine, Diphenyl Sulfide, Diphenyl Sulfoxide, and Diphenyl Sulfone. The gas phase decomposition kinetics of diphenyl sulfoxide, diphenyl sulfone, triphenylphosphine, diphenyl sulfide, and tetraphenylsilane were studied between 350 and 650 C. The decompositions are first order and the principal decomposition products common to all five compounds are benzene and high molecular weight polymers. Other major products obtained include sulfur dioxide and diphenyl sulfide from the sulfoxide; sulfur dioxide from the sulfone; hydrogen and phosphorus from the phosphine; hydrogen, hydrogen sulfide, and dibenzothiophene from the sulfide; and hydrogen and silicon from the silane. The kinetics suggest a molecular rearrangement mechanism, although a free-radical mechanism is not entirely excluded. ***Arthur Levy and Charles J. Ambrose.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-560, Oct. 1959, 34 pp. (TL507 Un3.18w Vis.)

8911 Thermodynamic Properties of Refractory Borides. I. Evaporation Behavior and Vapor Pressure of Zirconium Diboride. II. Phase Studies in the Tantalum-Boron System Between Ta and TaB. Vapor pressures of Zr over zirconium diboride in a tungsten crucible have been measued over the temperature range 2150 to 2475 K. Reaction of the solid boride with residual gases in the system producing volatile oxides was investigated and measured pressures were corrected for the increased volatility. The vaporization equation, the associated entropy change, and the enthalpy change are given. Phase studies of the solid portion of the Ta-B system were made between Ta and TaB. Two intermediate phases were found: $Ta_{2.4}B$ (referred to as Ta_2B in the literature) and Ta_3B_2. Both

have narrow ranges of homogeneity. $Ta_{2.4}B$ is stable only at hgh temperatures, decomposing at 2040 ± 30 C to Ta and Ta_3B_2. Ta_3B_2 is the low-temperature stable phase, decomposing above 2180 ± 20 C to $Ta_{2.4}B$ and TaB. Rates of reactions of the elements and of intermediate phases were investigated; these rates are believed responsible for errors in the work of previous investigators. ***James M. Leitmaker.*** *U. S. Atomic Energy Commission,* LA-2402, Apr. 13, 1960, 252 pp. (UF767 U3La Contin.)

8912* Determination of Rates and Mechanisms by Electron Spin Resonance. The occurrence of events with characteristic times in the range 10^{-9} to 10^{-4} seconds may produce observable effects on electron spin resonance spectra. In some cases, detailed information concerning mechanisms not accessible to standard kinetic methods may be obtained. ***S. I. Weissman.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 47-50.

8913* The Study of Hydrogen Exchange Kinetics by Nuclear Magnetic Resonance. The principles of the nuclear magnetic resonance (NMR) technique for studying fast proton exchange reactions are described. This method is applicable to reactions with a half-life in the range between about 0.001 and one second and requires no isotope labeling. It is based on broadening of the NMR resonance lines as a result of the exchange process. ***S. Meiboom.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 50-53.

8914* Investigation of Rapid Reaction Processes in Excited Molecules by Fluorescence Measurements. The conditions for the reaction of excited molecules and use of fluorescence measurements for the investigation of these reactions are presented. The evaluation of the measurements, including the correction for a non-stationary initial reaction, leads to a time independant rate constant. (*In German.*) Die Untersuchung schnell verlaufender Reaktionen angeregter Moleküle durch Fluoreszenzmessung. ***A. Weller.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 55-59.

8915* Fast Reactions in Solution by Flash Photolysis Methods. Flash photolysis techniques are particularly suitable to the study of rapid reactions in solution. Thermal effects are then negligible and Beers law is generally valid, even with low dispersion instruments. The time resolution of present equipment is shown to be adequate for the study of most reactions which are second-order in concentration and for first-order reactions with rate constants less than 10^5 sec^{-1}. ***G. Porter.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 59-63.

8916* A Review of Methods for the Measurement of Acoustic Relaxation in Aqueous Solutions. In aqueous solutions relaxation processes occur which are caused by the interactions of dissolved molecules with one another and with the solvent. A limiting factor in measurements is the weakness of relaxation effects for small concentrations. (*In German.*) Überblick über die Verfahren zur Messung der akustischen Relaxation in wässrigen Lösungen. ***K. Tamm.*** *Zeitschrift Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 73-78.

8917* Exchange Reactions in Complex Ions by NMR. Paramagnetic ions in solution have an effect on the line shape of a nuclear magnetic resonance signal, which depends either on the rate of transverse relaxation of magnetization of nuclei close to the ion or on the rate of exchange of such nuclei with more distant nuclei. A general equation is developed for the line width and criteria are established for distinguishing between relaxation and exchange effects. ***Ralph G. Pearson, Jay Palmer, Mary M. Anderson, and A. L. Allred.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 110-115.

8918* Tests of Solution Models by Quantum Yields for Dissociation. Any satisfactory theory of very fast reactions must be concerned not only with the diffusion coefficients of isolated reactants but also with the behavior of these reactants when they are so close together that they influence each other's diffusive characteristics. In order to test the magnitudes of these proximity effects, quantum yields for iodine dissociation in solvents of widely different viscosities were measured. ***Richard M. Noyes.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie,* v. 64, no. 1, Mar. 1960, p. 153-156.

8919* A Contribution to the Study of Water Steam Adsorption on Silicon Oxide Surfaces. The amount of fixed hydroxyl groups on "aerosil", a finely divided amorphous silicon dioxide product of the "Degussa", was found to be below the highest possible value per surface unit. The use of the water steam adsorption isotherms revealed that in "aerosil", in the first layer, fewer water molecules are adsorbed than in the case of a silica gel saturated with hydroxyl groups. (*In German.*) Zur Kenntnis der Wasserdampf-Adsorption an Siliciumdioxyd-Oberflächen. ***H. -P. Boehm and G. Kämpf.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 23, nos. 3-4, Feb. 1960, p. 257-266.

8920* A Study of the Rate of Adsorption of Surface Active Substances on a Metal. The rate of adsorption of octyl, hexyl, amyl and butyl alcohols on the surface of a zinc electrode has been studied by means of an electrochemical method. The rate of adsorption of the alcohols from 1*N* $ZnSO_4$ solutions has been found to be not very large and to considerably diminish on increasing the $ZnSO_4$ concentration to 4–6*N*. (*In Russian.*) Izuchenie skorosti adsorbtsii poverkhnostno-aktivnykh veshchestv na poverkhnosti metalla. ***Z. A. Solov'eva.*** *Zhurnal Fizicheskoĭ Khimii,* v. 34, no. 3, Mar. 1960, p. 537-542.

8921* The Kinetics and the Mechanism of Methane Oxidation. I. Basic Macrokinetic Laws. Kinetics of methane oxidation in a quartz stable surface vessel is studied. The relation between maximum rates of initial products consumption and reaction products accumulation is shown. The effective activation energy is found to be 43 ± 1 *kcal/mole.* (*In Russian.*) Kinetika i mekhanism okisleniia metana. I. Osnovyne makrokineticheskie zakonomernosti. ***L. V. Karmilova, N. S. Enikolopyan, and A. B. Nalbandyan.*** *Zhurnal Fizicheskoĭ Khimii,* v. 34, no. 3, Mar. 1960, p. 550-558.

8922* Unsteady Electrode Processes in Stirred Media. II. Voltammetry at Constant Current Density. Equations have been derived for the dependence between the electrode potential and duration of electrolysis for reversible and completely irreversible reactions. The dependence has been shown to differ for cases current above and below the limiting current. (*In Russian.*) Nestatsionarnye elektrodnye protsessy v peremeshivaemykh sredakh. II. Vol'tamperometriia pri postoiannoĭ sile toka. ***Yu. G. Siver.*** *Zhurnal Fizicheskoĭ Khimii,* v. 34, no. 3, Mar. 1960, p. 577-584.

8923* Phase Equilibria in the System Acetaldehyde—Carbon Dioxide. Phase equilibria in the system acetaldehyde–carbon dioxide have been studied at pressures up to 100 at. and temperatures from 1 to 50 C. Critical phenomena have been revealed in this system at temperatures above 32 C. (*In Russian.*) Fazovye roonovesiia v sisteme atsetal'degid–dvuokis' ugleroda. ***D. S. Tsiklis, L. I. Shenderei, and A. N. Kofman.*** *Zhurnal Fizicheskoĭ Khimii,* v. 34, no. 3, Mar. 1960, p. 585-586.

8924* Integral Heats of Solution of Perchloric Anhydride and of Its Mixtures With Perchloric Acid in Water at 25°C. The heat of solution increases linearly with the increase of the perchloric anhydride content in the mixture. The temperature of solution of perchloric anhydride in water at 25 C is 50.4 ± 0.3 kilocalories/mol. The heat of fusion of the monohydride of perchloric acid is $L_{fusion} = 2.46 \pm 0.08$ kilocalories/mol. (*In Russian.*) Integral'nye teploty rastvoreniia khlornogo angidrida i ego smeseĭ s khlornoĭ kislotoĭ v vode pri 25°. ***V. Ia. Rosolovskii, N. V. Krivtsov, and A. A. Zinov'ev.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 5, no. 4, Apr. 1960, p. 778-781.

8925* Heats of Formation and Thermal Capacities of Tetramine and Triamine of Bivalent Platinum. The true thermal capacities of $K_2[PtCl_4]$, $(NH_4)_2[PtCl_4]$, $[Pt(NH_3)_3Cl]Cl$ and $[Pt(NH_3)_4]Cl_2$ were measured between 25 and 75 C. These capacities have a linear dependency on temperature. The sharpness of the straight lines representing them increases with the increase of the number of molecules of ammonia in the internal sphere of the ammonium chloride complex compounds of bivalent Pt. By means of calorimetric measurements the heats of formation of $[Pt(NH_3)_4]Cl_2$ and $[Pt(NH_3)_3Cl]Cl$ were evaluated. (*In Russian.*) Teploty obrazovaniia i teploemkosti

tetrammina i triammina dvukhvalentnoĭ platiny. ***I. I. Cherniaev, V. A. Palkin, and R. A. Baranova.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 821-831.

8926* Polarographic Investigation of Complex Cadmium Compounds With Thiosemicarbazide and Semicarbazide. The reacton of the complex formation of Cd ions with thiosemicarbazide at different pH was studied. With a pH between five and seven, a complex with two coordinated groups is formed $[Cd(TS)_2]^{2+}$ $pK_2 = 5.5 \pm 0.15$. The composition and stability of the complex Cd compound was examined. The pK of the complex ions $[Cd(Sem)_2]^{2+}$ is equal to 3.3 ± 0.15. (*In Russian.*) Poliarograficheskoe issledovaie compleksnykh soedineniĭ kadmiia s tiosemikarbazidom i semikarbazidom. ***V. F. Toropova and K. V. Naĭmushina.*** *Zhurnal Neorganicheskoĭ Khimii*, v. 5, no. 4, Apr. 1960, p. 874-878.

8927* Oxidation of Cobalt Sulfide in the Presence of Sodium Chloride. In studying the process of oxidation of iron sulfide concentrate containing Co, it was found that sodium chloride fosters the transformation of Co into sulfate, which requires the presence of enough S in the initial material. A method for stimulating the proces of oxidation of cobalt sulfide in poor S concentrates by introducing iron sulfide into the batch was developed. (*In Russian.*) Okislenie sul'fida kobal'ta prisutstvii khloristogo natriia. ***A. Ia. Zvorykin and F. M. Perel'man.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 4, Apr. 1960, p. 765-768.

8928* Energetic Yield of Nitric Acid Decomposition Under the Effects of Ionizing Radiations. In studying the relationship between the energetic yield of N_2O, NO and NO_2 decomposition under the influence of ionizing radiations and the pressure (0-1.5 atm), temperature (0-400 C) and intensity of radiation (up to 10^{17} e.v./cm^{2}sec), it was found that the degree of resistance of NO, N_2O and NO_2 to the action of the radiations was contrary to the degree of their resistance to the action of high temperature. (*In Russian.*) Energeticheskiĭ vykhod razlozheniia okislov azota pod deĭstviem ioniziruiushchikh izlucheniĭ. ***M. T. Dmitriev, L. V. Saradzhev, and M. A. Mininovich.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 4, Apr. 1960, p. 808-814.

COATINGS

8929 Reaction Kinetics of Porcelain Enamel-Metal Systems. Reaction kinetics of elevated-temperature fusion reactions between various powdered metals and finely divided sodium borosilicate porcelain enamel frits were studied. The powdered metals employed were Ni, Co, Fe, and Mg. Quantitative X-ray diffraction was used to determine the amount of metallic ion in each reaction which had been reduced to the metallic state by the added metal. ***R. M. Spriggs and A. L. Friedberg.*** *American Ceramic Society, Journal*, v. 43, May 1960, p. 252-262.

8930 Sprayed Metal Coatings for Abrasion, Corrosion, and Oxidation Resistance. Development of nickel-chromium-boride-silicate hard-facing alloys and the production of powders from them which can be sprayed and then reheated to bond them to the underlying metal. ***G. R. Bell.*** *British Welding Journal*, v. 7, May 1960, p. 305-311.

8931 Sprayed Metal Coatings. Discusses development of metal spraying and types of equipment presently in commercial use that spray the metal in either powder or wire form. Sprayed Zn and Al coatings protect Fe and steel because they are anodic to those metals. ***G. A. Curson.*** *British Welding Journal*, v. 7, May 1960, p. 312-317.

8932 Hard-Facing With "Stellite" Powders. The Spray Fuse process has been applied to many components which are now in service. The Powder Weld technique, being much newer, is naturally at an earlier stage of development. ***J. R. Gault.*** *British Welding Journal*, v. 7, May 1960, p. 318-323.

8933 Hot-Dipped Metallic Coatings. The properties, preparation, and uses of metal coatings are compared. ***John H. Nicholls.*** *Corrosion Technology*, v. 7, Apr. 1960, p. 107 + 4 pages.

8934* Protective Chemical Surface Treatments of Metals. Chemical surface modifications of the metal surface, their systematic preparation and methods for their evaluation are presented. Some examples of inter-reactions between organic coatings and the underlying metal surface are given. ***Max Kronstein.*** *Current Engineering Practice*, v. 2, no. 8, Feb. 1960, p. 11-15.

8935 The Flame-Spraying of Ceramic Coatings. The same technique of spraying metal coatings was used to coat metals with a layer of high-temperature ceramic material. Alumina, because of its high melting point, chemical resistance, and other favorable properties, was used as test material for the basic technique in flame-spraying ceramic powders. (*In German.*) Das Flammspritzen von keramischen Überzugen. ***H. Meyer and A. Dietzel.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 37, Apr. 1960, p. 136-141.

8936 A Method of Measuring the Resistivity of Protective Coatings on Metals. Electrical resistivity can be determined directly from the instantaneous drop in potential ΔV represented by the height of the pulse, giving the resistance R as $\Delta V/I$. ***L. Rivola.*** *Engineers' Digest*, v. 21, Apr. 1960, p. 96-97.

8937* Application of Infra-Red Spectrography in Fats and Oils. III. Autoxidative Studies in Case of Some Synthetic Triglycerides. Follows the course of film formation of tri-α-elaeostearin and α-elaeostearo-dilinolin with IR-spectroscopy. The changes taking place in the characteristic bands in the spectra during the process of drying and film formation are discussed. (*In German.*) Anwendung der Infrarot-Spektrographie auf dem Fettgebiet. III. Untersuchung der Autoxydation synthetischer Triglycerid. ***H. P. Kaufmann and H. H. Thomas.*** *Fette, Seifen, Astrichmittel*, v. 62, no. 4, Apr. 1960, p. 315-318.

8938* Polyester Coatings and Their Application. Deals with the essential constituents of unsaturated polyester resins and gives various methods to prevent the inhibiting action of atmospheric oxygen during film formation, such as addition of small amounts of paraffin. New methods for the synthesis of polyester resins suitable for coatings are given which do not require the paraffins. (*In German.*) Zur Chemie der ungesättigten Lack-Polyesterharze. ***J. Kuchenbuch.*** *Fette, Seifen, Anstrichmittel*, v. 62, no. 4, Apr. 1960, p. 326-332.

8939* New Polyalcohols for the Surface-Coatings Industry. Trimethylol ethane and trimethylol propane are the new additions to the glycerol, pentaerythritol and other related polyhydroxy compounds which are used extensively for the manufacture of alkyd resins. Describes their use as polyester components, alone or in combination with other polyalcohols. (*In German.*) Neue Polyole für die Anstrichmittel-Industrie. ***P. W. Sherwood.*** *Fette, Seifen, Anstrichmittel*, v. 62, no. 4, Apr. 1960, p. 335-337.

8940* Testing New Mains, Services, Pipe Coatings and Corrosion Controls. Lists considerations which should be "must" at the inception of a new extension, and discusses testing methods. ***J. W. McAmis.*** *Gas Age*, v. 125, May 26, 1960, p. 27-29.

8941 Titania Opacified Porcelain Enamels. Crystallization, composition of enamel glass, properties of titania enamels, processing, special applications of titanium enamels are discussed. A bibliography is cited. ***R. D. Shannon and A. L. Friedberg.*** *Illinois, University, Engineering Experiment Station Bulletin No.* 456, 1960, 49 pp. (T1 I6b Vis.)

8942 Epoxy Resins. Covers forecasting epoxy resin markets, coatings from cyclohexene oxide derivatives, an epoxy resin from phenolphthalein, polyesters from epoxides and anhydrides, epoxy resin systems based on epoxidized soybean oil and hot anhydride, epoxy resins from resorcinol-acetone condensation products, and glycidyl ether reactivities in varnishes from liquid epoxy resins. ***J. R. Willner.*** *Industrial and Engineering Chemistry*, v. 52, Apr. 1960, p. 317-326.

8943 Paint Skinning. Its Cause and Prevention. Causes of skin forming on paint in containers and problem of keeping clean paint in dip tanks are discussed. ***Karl F. Schreiber.*** *Industrial Finshing*, v. 36, no. 7, May 1960, p. 21 + 3 pages.

8944 Painting Bed Springs With New Type Flow Coater. The principal feature of this flow coating installation is that eight vertical streams of paint do the job. These streams shoot upward from nozzles mounted in a moving manifold, set at

floor level. ***Paul F. Kunk.*** *Industrial Finishing*, v. 36, no. 7, May 1960, p. 32 + 4 pages.

8945 Painting Steel Drums. Steel drums are thoroughly cleaned, surface treated, dried off and spray painted inside and outside with specialized coatings designed to protect the contents, and to preserve and identify the outside. ***P. C. Bardin.*** *Industrial Finishing*, v. 36, no. 7, May 1960, p. 42 + 5 pages.

8946 Process Bonds Glass to Steel for Designing Versatility. Glass is a popular choice for handling corrosive, sticky or ultra-pure products, but the breakage problem often arises. One answer is to bond the glass to steel for structural strength. ***O. J. Britton.*** *Iron Age*, v. 185, no. 19, May 12, 1960, p. 144-145.

8947* Cladding Steel With Titanium—A Progress Report. Because it resists attack by many corrosive liquids, Ti in sheet form is an attractive material for vessels used in chemical and processing industries. ***J. L. Ma and C. Wright, Jr.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 76-79.

8948* Surface Treatments and Finishes for Magnesium. Where a finish is needed for protective or decorative reasons, a broad range of surface treatments are available for nearly any service condition. Examples are cited. ***James S. Kirkpatrick.*** *Modern Metals*, v. 16, no. 4, May 1960, p. 64 + 4 pages.

8949* Symposium on the Viscosity and Flow Properties of Paints. Types of flow, the problems of flow measurement, how related industries measure flow properties, how flow properties affect production and application, and flow control additives (thickeners and surface active agents) are discussed. ***R. M. Evans, et al.*** *Official Digest*, v. 32, May 1960, p. 567-781.

8950* Whiting Dispersions, Particle Packing and Surface Adsorption. Paste formation from whiting and thin oily liquids, and changes in consistency of pastes on standing and when mixed have been investigated and interpreted. True oil absorption has been redefined. The degree of flocculation and the resistance to hard settlement on storage of non-aqueous suspensions of whiting have been correlated with the surface properties of layers adsorbed on the particles. ***R. R. Davidson.*** *Oil & Colour Chemists' Association, Journal*, v. 43, May 1960, p. 307-349.

8951* Styrenated-Acrylated Epoxy-DCO Resins for Industrial Coatings. The "internal plasticising" effect of some acrylic esters is used to make highly styrenated epoxy-DCO resins more flexible. Preparation of the resins, copolymerisation and film properties are discussed. ***L. Kovacs and J. Zarb.*** *Oil & Colour Chemists' Association, Journal*, v. 43, May 1960, p. 350-354.

8952* How to Manufacture Foolproof Aerosol Paints. Manufacture and quality control of aerosol paints is described. ***John J. McNally.*** *Paint and Varnish Production*, v. 50, no. 6, May 1960, p. 55-57.

8953* Vinyl Chloride Acrylic Outdoor Latex Paint. General characteristics are given. Ultraviolet absorption; water resistance; efflorescence; pigment binding power; and staining and chalky substrate problems are discussed. ***O. Z. Tyler.*** *Paint Industry Magazine*, v. 75, May 1960, p. 10 + 2 pages.

8954* Review of Colored Pigments. Organic Pigments. Bright Inorganics. Oxide Pigments. Carbon Blacks. Typical characteristics and classification of organic pigments, a description of bright inorganic colors, general properties and a classification of oxide pigments are given. Manufacturing processes and special uses of carbon black, and predispersed blacks are discussed. ***E. R. Stacy, Michael J. Dunn, Charles H. Love, and L. J. Venuto.*** *Paint Industry Magazine*, v. 75, May 1960, p. 14-22.

8955 A View of Antifouling. Pertains to ships' hulls. ***Neil R. Fisk.*** *Paint Technology*, v. 24, May 1960, p. 15-18.

8956 Petroleum Refinery Experience With Epoxy Coatings. *H. W. Howard, F. T. Radecke, and P. R. Scheibli.* *Paint Technology*, v. 24, May 1960, p. 22-25.

8957 How to Specify Finishes for Magnesium. A guide to the most suitable finish system, including chemical treatments and organic coatings for best properties at lowest cost. ***John A. Stevens.*** *Product Engineering*, v. 31, no. 23, June 6, 1960, p. 31-35.

8958* Chemical Nickel Plating. Methods applicable to chemical nickel plating by the Kanigen process are described. ***G. FitzGerald-Lee.*** *Product Finishing*, v. 13, May 1960, p. 68-70.

8959* Inspection and Testing of Organic Finishes. Reports on the inspection and testing of organic finishes. ***A. R. Purchase.*** *Product Finishing*, v. 13, May 1960, p. 89-92.

8960 European Paint-Hardness Testers Versus the Sward Rocker. The Persoz instrument for paint hardness testing is the most satisfactory, considering practicality, repeatability and precision. Sensitivity to small differences in hardness is better than with the Sward rocker. ***Marcel Dierckx.*** *Products Finishing*, v. 24, no. 8, May 1960, p. 52 + 8 pages.

8961* Special Enamels for High Temperatures. II. Tests With High Temperature Enamels on Alloyed Steels. Enamels protect steels against oxidation and intercrystalline corrosion at temperatures up to 900 C; increasing the stability and life of the materials. Developemnt of high temperature enamels for unalloyed and alloyed steels and the technology involved is described. (*In German.*) Spezialemails für hohe Temperaturen. II. Versuche mit Hochtemperaturemails auf legierten Stählen. ***A. Petzold and H. Betzer.*** *Sprechsaal*, v. 93, no. 9, May 5, 1960, p. 252-255.

8962 Decontamination Testing of Highly Contaminated Protective Coatings. Decontaminability measurements of 34 protective coatings and ten comparative control surfaces highly contaminated with either mixed fission products from typical Purex waste or Oak Ridge National Laboratory Thorex waste did not indicate any unusual improvement over coatings tested in 1950. Only Ucilon-K, Amercoat-31, Peel-Filmite, Nukemite-40 and possibly Amercoat-35 and Polychem-1500 appeared useful in the presence of Thorex contamination. ***G. A. West and C. D. Watson.*** *U. S. Atomic Energy Commission, ORNL*-2811, May 6, 1960, 26 pp. (UF767 U3o Contin.)

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

8963* Estimating of Interval Quantization Effect on Processes in Digital Automatic Control Systems. The effect of interval quantization in digital automatic control systems continuous parts of which contain both constant parameters and variable ones was determined. (*In Russian.*) Otsenka vliyaniya kvantovaniya po urovnyu na protsessy v tsifrovykh avtomaticheskikh sistemakh. ***Ya. Z. Tsypkin.*** *Avtomatika i Telemekhanika*, v. 21, no. 3, Mar. 1960, p. 281-285.

8964* Analysis of Two-Position Compensation Control System With Constant Prolonged Disturbances. It is shown that the simplified analytical method of calculating two-position control process can be used to analyze processes in a two-position compensation control system with constant prolonged disturbances. (*In Russian.*) Analiz sistemy dvukhpozitsionnogo regulirovaniya s korrektsiyey pri postoyannykh dlitel'nykh vozmushcheniyakh. ***A. I. Cherepanev.*** *Avtomatika i Telemekhanika*, v. 21, no. 3, Mar. 1960, p. 310-316.

8965* On Noise Stability of Incremental Coding. Potential noise stability of incremental coding with fluctuation noises is determined. The noise stability of incremental coding is compared with the noise stability of pulse-code modulation and of delta-modulation. The comparison shows that the noise stability of incremental coding is sometimes better than the noise stability of pulse-code modulation or the noise stability of delta-modulation. (*In Russian.*) O pomekhoustoychivosti raznostno-diskretnogo metoda peredachi informatsii. ***V. M. Baikovsky.*** *Avtomatika i Telemekhanika*, v. 21, no. 3, Mar. 1960, p. 344-358.

8966* Dynamics of Electromagnetic Control Element. An equation for motion of an electromagnetic control element of a turning type is deduced. The theoretical results are compared with the experimental ones. (*In Russian.*) Dinamika elektromagnitnogo upravliaiushchego elementa. ***I. E. Dekabrun, N. P. Kozlov, and I. M. Krassov.*** *Avtomatika i Telemekhanika*, v. 21, no. 4, Apr. 1960, p. 506-512.

8967* To Problem of Reliability of Switching Devices. Increasing reliability of switching devices operation by means of reserving elements is considered. There is proposed a new method of reserving for multistage circuits which permits to increase reliability of the device with minimum number of spare relays. (*In Russian.*) K voprosu nadezhnosti releĭno-kontaktnykh ustroĭstv. ***K. P. Kurdiukov.*** *Avtomatika i Telemekhanika*, v. 21, no. 4, Apr. 1960, p. 533-541.

8968* Combined Application of Control "By Disturbances" and the Principle of Self-Optimizing of Parameters in a Servomechanism With a Limited Number of Differentiators. The basic difficulty in the practical application of the principle of invariantness to servomechanism is that many of them receive at the amplifier input control action together with noise of a high level. In practice, only the first or first and second derivatives of the action can be used in these cases for increasing accuracy. (*In Russian.*) Kombinirovannoe ispol'zovanie upravleniia po vozmushcheniiu i principa samoizmeniia parametrov v slediashchei sisteme pri nepolnom chisle differentsiatorov. ***V. I. Kostyuk.*** *Avtomatyka*, 1960, no. 1, p. 36-37.

8969* Direct Metering for a Transformer Analogue Computer. Computer voltages are phase shifted and added together by amplifiers and the resultants are supplied to adjustable gain amplifiers. These feed power amplifiers with current feedback which control ammeters and wattmeters. A calibrated phase shifter is used for phase measurement. ***J. F. Young.*** *Electronic Engineering*, v. 32, May 1960, p. 280-288.

8970 Fundamental Theory of Automatic Linear Feedback Control Systems. The benefits of feedback are paid for in gain-bandwidth of active elements over and above what is needed to physically do the job. The minimum price that must be paid is independent of configuration. The system with two degrees of freedom is studied in detail. ***Isaac M. Horowitz.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 5-19. (TK1 In6.6ac Vis.)

8971 General Approach to Control Theory Based on the Methods of Lyapunov. An introduction to the second method of Lyapunov in determining the stability of linear and nonlinear control systems. Although almost universally referred to in Russia and although it is becoming an increasingly important concept, this method has not been used in English-speaking countries because of the lack of suitable translation. ***R. E. Kalman and J. E. Bertram.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 20. (TK1 In6.6ac Vis.)

8972 The Impact of Information Conversion on Control. Nine basic functional tools have been identified which describe the complete information conversion process - sensing, converting, storing, communicating, computing, programming, regulating, actuating, and presenting. ***Harold Chestnut and Walter Mikelson.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 21-29. (TK1 In6.6ac Vis.)

8973 Controlled Propulsion. The Jupiter S-3D engine, the Saturn booster are discussed. ***Konrad K. Dannenberg.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 30-33. (TK1 In6.6ac Vis.)

8974 A Root-Locus Method for the Analysis of Nonlinear Servomechanisms. The nonlinear servomechanisms that can be treated by this method are systems that contain nonlinear elements whose input-output relationships can be expressed in the form of power series. ***Malcolm J. Abzug.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 38-44. (TK1 In6.6ac Vis.)

8975 On the Analysis of Bi-Stable Control Systems. The relationship between switch gain at control frequencies and switch gain at oscillation frequency is noted. The inherent insensitivity of the bistable oscillating system to variations in linear loop parameters is discussed. ***B. E. Amsler and R. E. Gorozdos.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 46-58. (TK1 In6.6ac Vis.)

8976 Pendulous Velocity Meter Control Synthesis. A velocity meter (VM) is a singly-integrating, acceleration-sensing instrument which has become important in providing precise, continuous velocity information for navigation of a wide variety of vehicles, from submarines to ballistic missiles. ***S. G. Shutt and S. A. White.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 60-70. (TK1 In6.6ac Vis.)

8977 The Analysis of Demodulating Compensating Networks. A method for determining a sampled-data system which is equivalent to a given member of a class of periodically switched electric networks is presented. A technique for determining the response of the system to a given input function is discussed. ***Gordon J. Murphy and John F. Egan.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 71-80. (TK1 In6.6ac Vis.)

8978 Multi-Loop Automatic Temperature Control System Design for Fluid Dynamics Facility Having Several Long Transport Delays. Important simplifications introduced to make the analysis and design work tractable include: (a) Application of the mathematical analogy between the theory of electric transmission lines and gas flow to validate the separation of temperature and pressure variations, (b) Selection of control frequency to permit lumped-parameter representation. ***G. J. Fiedler and J. J. Landy.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 81-96. (TK1 In6.6ac Vis.)

8979 Some Linear and Nonlinear Aspects of Hot Gas Servo Design. Gas servos are considered from a feedback analysis standpoint with emphasis on systems such as would be most suitable for missile applications. Linearized equations are presented for the case where the piston is operating off-center. ***R. V. Halstenberg.*** *IRE Transactons on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 97-107.

8980 Control System Analysis and Design Via the Second Method of Lyapunov: I. Continuous-Time Systems. II. Discrete Time Systems. ***R. E. Kalman and J. E. Bertram.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 112. (TK1 In6.6ac Vis.)

8981 Electronic Gain Control in Automatic Flight Control Systems. Deals with the problems involved in implementing electronic, stored function, control of automatic flight control system channel gains. ***William Henn and Eugene L. Boronow.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 116-119. (TK1 In6.6ac Vis.)

8982 Electronic Memory in Automatic Flight Control Systems. Describes a fast, accurate, infinite time constant electronic solid-state memory for use in a-c control systems. This memory system is based on the characteristics of the transfluxor. ***David H. Blauvelt and Arthur S. Robinson.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 128-132. (TK1 In6.6ac Vis.)

8983 Pulse Controlled Integration in Automatic Flight Control Systems. Describes two types of all electronic pulse-controlled a-c voltage integrators. The first technique requires a single transfluxor per integrator and is suitable for medium accuracy applications. The second technique utilizes two transfluxors per integrator and is suitable for applications requiring substantially higher accuracies. ***Arthur S. Robinson.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 133-138. (TK1 In6.6ac Vis.)

8984 Reaction Wheel Attitude Control for Space Vehicles. An attitude control system consisting of motor-driven inertial wheels in conjunction with an over-riding mass ejection system is proposed for use in space vehicles. Control by mass ejection is used to compensate for initial disturbances during separation from the booster. ***Ronald W. Froelich and Harry Patapoff.*** *IRE Transactions on Automatic Control*, v. AC-4, no. 3, Dec. 1959, p. 139-149. (TK1 In6.6ac Vis.)

8985 D-Decomposition Analysis of Automatic Control Systems. Development of the basic theory of D-decomposition by a general polynomial expression is followed by account of: the basic theory of parametric stability; unity-feedback variable-gain analysis, transient response determination; and sampled-data system analysis. ***Rolf W. Lanzkron and Thomas J. Higgins.*** *IRE Transactions on Automatic Control,* v. AC-4, no. 3, Dec. 1959, p. 150-171. (TK1 In6.6ac Vis.)

8986 Application of Pole-Zero Concepts to Design of Sampled-Data Systems. Relates the pole-zero configuration of an error-sampled control system to the transient and steady-state response in a form amenable to straightforward synthesis procedures. ***D. P. Lindorff.*** *IRE Transactions on Automatic Control,* v. AC-4, no .3, Dec. 1959, p. 173-184. (TK1 In6.6ac Vis.)

8987 Synthesis of Feedback Systems With Specified Open-Loop and Closed-Loop Poles and Zeros. Describes a graphical method for synthesizing a compensation network where the fixed poles and zeros of the open-loop system are given. The resulting network is general in that it may have both real and complex poles and zeros. ***W. E. Carpenter.*** *IRE Transactions on Automatic Control,* v. AC-4, no. 3, Dec. 1959, p. 185-196. (TK1 In6.6ac Vis.)

8988 Spectral Characterization of Control System Nonlinearities. For purposes of simulation, a power spectrum is developed for the ensemble of feedback error functions. This power spectrum is then used to synthesize artificial nonlinearities in the simulation of the control system. ***R. B. McGhee.*** *IRE Transactions on Automatic Control,* v. AC-4, no. 3, Dec. 1959, p. 199-211. (TK1 In6.6ac Vis.)

8989 Techniques for the Optimum Synthesis of Multipole Control Systems With Random Processes as Inputs. The system under investigation is linear and time invariant. The input to each terminal shall consist of signal and noise. The synthesis procedure is carried out under the basic that a fixed plant must be compensated in order to perform certain desired tasks. ***H. C. Hsieh and C. T. Leondes.*** *IRE Transactions on Automatic Control,* v. AC-4, no. 3, Dec. 1959, p. 212-231. (TK1 In6.6ac Vis.)

8990 Predictor-Relay Servos With Random Inputs. An evaluation of a proposal by O. J. M. Smith on the control, by Wiener prediction and a nonlinear combination of input and feedback signals, of a saturing element driving a primarily inertial load, with the error signal also being discussed. ***Thomas R. Benedict.*** *IRE Transactions on Automatic Control,* v. AC-4, no. 3, Dec. 1959, p. 232-245. (TK1 In6.6ac Vis.)

8991 Transistor Pulse Circuits for 160-MC Clock Rates. I. Pulse Regeneration. II. Parallel-to-Serial Multiplexing. Discusses transistor circuits capable of regenerating 6.25-mμ sec pulses at a 160-mc bit rate and techniques for multiplexing 16 digital signals with a 10-mc clock rate into a single signal with a 160-mc clock rate. Two methods of performing the regeneration function are presented. Concerning multiplexing techniques, 16 synchronous signals are applied to 16 AND gates along with a 10-mc narrow gate pulse. I. ***W. J. Giguere, J. H. Jamison, and J. C. Noll.*** II. ***J. C. Noll.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 432-438. (TK1 In6.6e Vis.)

8992 A Note on the Number of Internal Variable Assignments for Sequential Switching Circuits. An important step in the synthesis of sequential switching circuits is the assignment of binary variable states to represent internal states of the circuit. A formula is derived here which indicates the number of different assignments which can be made for flow tables having a given number of rows. ***E. J. McCluskey, Jr. and S. H. Unger.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 439-440. (TK1 In6.6e Vis.)

8993 Synthesis of Minimal-State Machines. A technique is presented which yields a minimal-state machine satisfying a given set of behavioral specifications. The machine is constructed in the same manner as has commonly been done in the past in synthesizing a "primitive flow table." ***Seymour Ginsburg.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 441-449. (TK1 In6.6e Vis.)

8994 Arithmetic Operations for Digital Computers Using a Modified Reflected Binary Code. Presents a method for performing the arithmetic operations of addition, subtraction, multiplication, and division using a modified reflected binary code. The modification for integral numbers is essentially the addition of an even parity check bit to the Gray code representation. ***Harold M. Lucal.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 449-458. (TK1 In6.6e Vis.)

8995 Magnetic Fields of Square-Loop Thin Films of Oblate Spheroidal Geometry. Thin films of Ni-Fe alloy may be prepared to be anisotropic and exhibit square-loop *M-H* characteristics. In films that are single-domained with flux changes involving only rotation of intrinsic magnetization controlled by cross-magnetization fields, very fast switching action can be obtained for storage and logic functions. ***H. Chang and A. G. Milnes.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 458-464. (TK1 In6.6e Vis.)

8996 Electrodeposited Twistor and Bit Wire Components. Electrodeposition of ferromagnetic materials on wire is a suitable way of producing magnetic storage elements. One form of this element, when placed under suitable torsional strain (i.e., as a twistor), has magnetic properties suitable for memory application. Through research into the electrodeposition process, a new device, the bit wire, has been developed. ***S. J. Schwartz and J. S. Sallo.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 465-469. (TK1 In6.6e Vis.)

8997 Nondestructive Readout of Metallic-Tape Computer Cores. The subject of this investigation is nondestructive readout of metallic-tape memory cores by the application of a magnetomotive force spatially in quadrature to the direction of remanent flux. A simple method of fabrication is proposed and empirical data for the design of the nondestructive read systems is obtained. ***L. M. Lambert.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 470-474. (TK1 In6.6e Vis.)

8998 Diode-Steered Magnetic-Core Memory. Describes techniques which take advantage of word arrangement to make possible large, high-speed magnetic-core memories at moderate cost. Economy is obtained by means of a two-coordinate selection system using diffused junction rectifiers as steering diodes. ***A. Melmed and R. Sherlin.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 474-478. (TK1 In6.6e Vis.)

8999 The Design of a Large Electrostatic Memory. A large, high-speed random-access memory for the Brookhaven "Merlin" digital computer is described. This system employs barrier grid electrostatic storage tubes in a novel configuration yielding improved reliability. ***M. Graham, G. L. Miller, H. R. Pate, and R. Spinrad.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 479-485. (TK1 In6.6e Vis.)

9000 Systematic Scaling for Digital Differential Analyzers. Shows how the scaling constraints can be organized in a matrix form, and how optimal scales can be produced in a systematic manner. The proposed scheme, which can be programmed for automatic execution, is adaptable for DDA's operating in conjunction with general-purpose digital computers. ***Arthur Gill.*** *IRE Transactions on Electronic Computers,* v. EC-8, no. 4, Dec. 1959, p. 486-489. (TK1 In6.6e Vis.)

9001 International Symposium on the Theory of Switching, Proceedings. Pt. I-II. Abstract models I and II, contact networks, magnetic and transistor logic I and II, switching systems, new switches, and concluding remarks are discussed. v. XXIX, Pt. I, 305 pp.; v. XXX, Pt. II, 345 pp. 1959. Harvard University Press, Cambridge, Mass. (TK7885 In8p)

9002 A Practical Manual on the Monte Carlo Method for Random Walk Problems. Basic principles, the source routine, the main free path and transmission, the collision or escape routine, the collision routine for neutrons, photon collisions, direction parameters after collision, terminal classification, remarks on computation and other problems are discussed. ***E. D. Cashwell and C. J. Everett.*** 153 pp. 1959. Pergamon Press, New York. (QA273 C26p)

9003* Non-Linear Control Systems. Provided the nonlinearities are instantaneous and occur in the forward loop external to the load they are under the control of the designer of the control system and can be used to advantage in improving the performance. If, however, the nonlinearity is in the load or the feedback path, the governing equations are complex even for instantaneous nonlinearities and the solution is by no means simple. ***J. F. Coales.*** *Process Control and Automation*, v. 7, May 1960, p. 196-204.

9004* Fundamental Pneumatics for Automation. IV. The article shows how the various pneumatic components previously described are utilized to build up simple control circuits for various purposes. ***R. E. Wilby.*** *Process Control and Automation*, v. 7, May 1960, p. 205-209.

ELECTRICAL ENGINEERING

9005* A New Principle for Contactless Signalling. The arrangement for contactless signalling comprises three main parts, a control magnet, a receiving head with a Hall generator and a transistor amplifier. When the control magnet passes the receiving head it excites the Hall generator, and the Hall voltage produced is then handled by a transistor amplifier. The individual constructional elements of a contactless signalling arrangement of this type are described, and their physical and technical characteristics discussed. Two typical applications of the new principle are given, one in control engineering, and the other in automation. (*In German.*) Ein neues Prinzip zur kontaktlosen Signalgabe. ***Walter Engel, Friedrich Kuhrt, and Hans Joachim Lippmann.*** *ETZ: Elektrotechnische Zeitschrift*, v. 81, Ausgabe A, no. 9, Apr. 1960, p. 323-327.

9006* The Reduction, Dissipation and Utilization of Transformer Heat Loss. The losses in transformers can be considerably reduced by the use of cold-rolled sheets cut at an angle, by elimination of bolts and by slender core construction. The dissipation of heat in the cooling circuit is facilitated by using low-viscosity oil. The utilization of the waste heat is realized by means of heat exchangers for space heating. (*In German.*) Senkung, Abfuhr und Verwertung der Transformatoren-Verlustwärme. ***Viktor Aigner.*** *ETZ: Elektrotechnische Zeitschrift*, v. 12, Ausgabe B, no. 7, Apr. 1960, p. 145 + 9 pages.

9007* Electrical Insulation. Insulation characteristics, breakdown, design problem, hi-pot testing, selection of specific insulations, applications are discussed. *Electromechanical Design*, v. 4, no. 5, May 1960, p. 65 + 22 pages.

9008 Double Coil Relay With One Working Gap. Rectangular shaped, miniature relays dictate a two-coil design if sufficient ampere-turns are to be available. This design gives a two-coil relay with a single working gap. ***John C. Schuessler.*** *Electronic Industries*, v. 19, May 1960, p. 79-82.

9009* The Automatization of Electrical Winches. The automatization of electrical conveying winches has rapidly developed, whereby especially the pole-changeable short-circuit rotor motor is widely used. (*In German.*) Die Automatisierung von Elektroförderhaspeln. ***Oswald Zinner.*** *Glückauf; Bergamännische Zeitschrift*, v. 96, no. 9, Apr. 23, 1960, p. 562-570.

9010 The Stability of a Dielectric Liquid Jet in Presence of a Longitudinal Electric Field. Shows that the electric field increases the stability of the jet. For given values of electric field, the wavelength of the disturbance at which the instability sets in and the wavelength which has maximum rate of instability are calculated. ***N. K. Nayyar and G. S. Murty.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 369-373.

9011 The Relay Guide. A Compendium of Electromechanical Relays Marketed in the United States. The following relays are cited: general purpose, telephone, miniature, rotary, power, plunger, motor starting, high voltage, vacuum, mercury, sensitive, polarized, high speed, snap action, radio frequency, subminiature, latching, frequency sensitive, electronic, time delay, overload, special purpose. Stepping switches are also cited. ***Raymond W. Auger and Karlann Puerschner, editors.*** 383 pp. 1960. Reinhold Publishing Corp., New York. (TK2861 Au42r)

9012 Some Properties of a Graded Vacuum Spark Gap. A high power, low inductance vacuum spark gap combination is described, which is capable of a dc operation over a wide voltage range. The electrical properties are discussed in regard to shorting and multiple switch operation. The coating of the inner surface of the insulator with evaporated and sputtered electrode material is absent in this design. ***J. W. Mather and A. H. Williams.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 297-303.

9013 High Precision Large Current Regulator. A versatile high current regulator using transistors for the series regulating element and capable of accuracies of a few parts per million is described. A solid state dc power supply capable of delivering 50 amp at 50 v is also described. ***K. C. Brog and F. J. Milford.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 321-322.

9014* Progress in the Generation, Distribution and Use of Electric Power in Ironworks. Generation of electric power, gas turbine improvements, advances in the design of generators, future development of power economy, distribution of the electric current, and other problems are discussed. (*In German.*) Fortschritte beim Erzeugen, Verteilen und Verwenden der elektrischen Energie im Hüttenwerk. ***Gustav Lemcke.*** *Stahl und Eisen*, v. 80, no. 8, Apr. 14, 1960, p. 498-502.

See also: **9308** (applications of thermoelectricity); **9367** (electrical analog for heat-flow analysis).

ELECTROCHEMISTRY

9015 The Change in Open-Circuit Potential of the Manganese Dioxide Electrode on Discharge and the Discharge Mechanism. Discharge of electrodeposited MnO_2 electrodes for successive short periods at *p*H 8, with time for reattainment of equilibrium, shows that the potential of partially discharged MnO_2 is a linear function of the amount of lower oxide formed over part of the discharge. ***W. C. Vosburgh and James H. DeLap.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 255-258.

9016 Nickel-Aluminum Alloy Coating Produced by Electrodeposition and Diffusion. Nickel-aluminum alloy coatings were produced by diffusion of Al electrodeposited over Ni. The Al was plated from baths operated at 25 - 1000 C. The alloys were much harder than Ni and were superior to nickel coatings in salt spray, atmospheric exposure and air oxidation tests. ***Dwight E. Couch and Jean H. Connor.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 272-276.

9017 Effect of Addition Agents on Tungsten Codeposition. Small quantities of certain addition agents will prevent the codeposition of W with Fe, Ni, or Co. Polarographic data indicate that addition agents which prevent W codeposition are capable of being adsorbed at the Hg cathode and form complexes with the codepositing metal ion. ***J. S. Sallo and R. D. Fisher.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 277-280.

9018 Anodization of InSb. The dependence of the constant current anodization curve on crystallographic face and illumination is reported for monocrystalline InSb. It is shown that illumination changes the film formation rate, either increasing or decreasing it depending upon certain experimental conditions. ***J. D. Venables and R. M. Broudy.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 296-298.

9019 Electrolytic Reduction of Nitro- and Dinitrotetralins. The polarographic reduction of mono- and dinitrotetralins was studied in buffered solutions at four different *p*H values. The reduction became more difficult and was less complete with increase in *p*H. ***R. N. Boyd, A. A. Reidlinger, and M. J. Sher.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 302-304.

9020 A Study of the Factors Affecting the Electrical Characteristics of Sintered Tantalum Anodes. Measurements were made of the electrical characteristics (d-c leakage, capacitance and equivalent series resistance) of anodically oxidized sintered Ta pellets, which were made from three Ta powders of different purities, particle shapes and particle size distributions. The

apparent densities of the pellets after sintering were also measured. ***G. L. Marin, C. J. B. Fincham, and E. E. Chadsey, Jr.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 332-337.

9021 The Growth of Anodic Oxide Films on Germanium. Thick uniform germanium dioxide films of controlled thickness were grown anodically on both n- and p-type Ge. The electrolyte used was a 0.25 *N* solution of anhydrous sodium acetate in glacial acetic acid. The composition of the films was established by gravimetric and spectrometric methods. ***Solomon Zwerdling and Sumner Sheff.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 338-342.

9022* Anodic Electrocrystallization. Methods for investigating the kinetics of electrocrystallization were reviewed and theoretical basis of some of these methods was discussed. The effect of surface diffusion in measurements at constant potential, in the steady state, in polarization at constant potential after maintaining a steady state of growth, and in measurements at constant current receives particular emphasis. These methods are compared and it is shown that the first two have certain advantages. The diffusion- and lattice-building process in the anodic electrocrystallization reactions is found to be rapid compared to electrochemical deposition. ***M. Fleischmann and H. R. Thirsk.*** *Electrochimica Acta*, v. 2, nos. 1-3, Feb. 1960, p. 22-49 + 1 plate.

9023* The Structure of Electrodeposited Copper. I. An Experimental Study of the Growth of Copper During Electrodeposition. II. The Nucleation of Copper Electrodeposits on Copper Substrates. The surface topography of Cu deposits grown from acid copper sulphate solutions on electropolished Cu cathodes, varies with the orientation of the original cathode surface. The deposit structures fall into groups which may be related to the atomic configuration of the original cathode surface. The nature of the variation can be explained on the hypothesis that growth proceeds by a bunching mechanism. The nucleation of Cu electrodeposits on Cu cathodes was studied, and it was found that initial mode deposit-growth is strongly dependent upon both the purity and orientation of the cathode. Small visible impurities, such as sulphides or oxides, can act as nucleation centres and mechanisms are proposed to explain the effects. I. ***H. J. Pick, G. G. Storey, and T. B. Vaughan.*** II. ***T. B. Vaughan and H. J. Pick.*** *Electrochimica Acta*, v. 2, nos. 1-3, Feb. 1960, p. 165-194 + 21 plates.

9024* Russian Practice in Electropolishing Steel. ***N. P. Fedot'ev and S. Ya. Grilikhes.*** *Electroplating and Metal Finishing*, v. 13, Apr. 1960, p. 119-125.

9025* The Electrodeposition of Copper, Nickel and Bi-Metal Sheets. The sheets made by this process are easily welded and soldered. If dead soft sheets are required they can be annealed at a temperature well below that used for rolled sheets. The process could be developed economically to make thin sheets of the kind used for motor car gaskets and radiators, or for bi-metal sheet which can readily be pressed into such articles as saucepans, without heat treatment. ***E. Carrington.*** *Electroplating and Metal Finishing*, v. 13, Apr. 1960, p. 126 + 4 pages.

9026 On the Assessment of Sealing of Anodic Oxide Films on Aluminium. A colorimetric method of estimating the degree of sealing of anodic oxide films of Al is described. The sealed film is post-sealed for a standard time in potassium dichromate solution, dissolved in sodium hydroxide solution, and the chromate in the resulting solution determined by diphenylcarbazide. ***T. P. Hoar and G. C. Wood.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 1, Spring, 1960, p. 7-10.

9027 The Growth Habit of Electrodeposited Copper. By plating under base reproduction conditions in an acidified copper sulphate solution, the growth processes occurring at polycrystalline cathodes were studied and compared with those at single crystal cathodes. It was found that the surface topography of the deposit formed on any one grain of the polycrystalline aggregate is identical to that of a deposit, grown under similar conditions, on a single crystal of the same orientation. ***G. G. Storey and S. C. Barnes.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 1, Spring, 1960, p. 11-20.

9028 The Throwing Power of Nickel and Other Plating Solutions. A method is described for measuring throwing power using a Hull cell. Throwing power is express in terms of thickness of deposit, measured at various points across the cathode, and of primary current distribution, determined on a conducting paper model of the cell. Data are provided to show the reproducibility obtained by the new technique. ***S. A. Watson.*** *Institute of Metal Finishing, Transactions*, v. 37, pt. 1, Spring, 1960, p. 28-39 .

9029* Electrolytic Local Polishing for Metallography of Beryllium, Zirconium and Molybdenum. A new technique of electrolytic local polishing using a plug which acts both as a mobile cathode and container for the electrolyte is described. This development provides advantages. Operating conditions and some results are given. (*In French.*) Polissage électrolytique local (technique "ellopol" pour la métallographie du béryllium, du zirconium et du molybdène. ***Pierre-A. Jacquet.*** *Journal of the Less-Common Metals*, v. 1, no. 6, Dec. 1959, p. 439-455.

9030 A Preliminary Study of the Relationship Between Tin Coating Grain Size of Electrotinplate and Flow-Brightening Conditions. Results of exploratory work performed on a new laboratory electrotinplate flow-brightening unit. It is shown that the grain size of electrolytic tinplate may be influenced by numerous factors, which include strip temperature, strip speed, quench temperature, and circulation in the quenching tank. The Sn coating thickness and original smoothness of the steel base also have a limited influence. ***C. J. Thwaites.*** *Metallurgia*, v. 61, Mar. 1960, p. 113-121.

9031 Tracer Follows Leveler in Electroplating Bath. Normal electrodeposition accentuates roughness by putting more metal on peaks than in valleys. A radioactive tracer shows how some additives reverse the effect to make smooth deposits. ***Seward E. Beacom and Bernard J. Riley.*** *Nucleonics*, v. 18, May 1960, p. 82-84.

9032 Novel Process for Plating Nickel on Aluminum Alloys. A new porcess for nickel plating Al from sulfate-fluoborate-chloride baths was developed. Adhesion values of about 5000 psi in shear were obtained regularly, and still better adhesion could result from the use of a proper heat treatment. The process eliminates zincate or other pretreatments for all Al alloys tested. ***James T. N. Atkinson.*** *Plating*, v. 47, May 1960, p. 509-512.

9033* Possibilities of Application and Limitations of the Polarographic Method for the Investigation of Chemical Reactions in Solutions. Conditions of the reaction layer near the electrode surface caused by a rapid chemical reaction controlling the electrode process are discussed. The limits of the rate constants which can be obtained by polarographic kinetic currents are determined. The case is considered where the reaction layer is partially or completely in the diffusion part of the electrode double layer. (*In German.*) Anwendungsmöglichkeiten und Begrenzungen der polarographischen Methode zur Verfolgung schneller chemischer Reaktionen in Lösungen. ***J. Koryta.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 1, Mar. 1960, p. 23-29.

9034* The Detection of Rapid Chemical Reactions During a Potentiostatic Course or an Electrode Reaction. The effect of a chemical reaction step on the course of an electrode reaction is described and it is found that potentiostatic experiments are very suitable for the analysis of the process. The application of the method to the system $[Cd(CN)_4]^{2} \rightleftharpoons [Cd(CN)_3]^{-} + CN$ is described. The results give an insight into the difficulties involved in the interpretation of rate constants obtained in this manner. (*In German.*) Die Erfassung schneller chemischer Reaktionen im potentiostatischen Ablauf einer Elektrodenreaktion. ***H. Gerischer.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 1, Mar. 1960, p. 29-35.

9035* Double Layer Corrections in the Evaluation of Rate and Equilibrium Constants of Fast Homogeneous Reactions, Coupled With Electrode Reactions—Some Potentialities of the Galvanostatic Method. The influence of the double layer on the overall rate of electrochemical processes controlled by a prior volume chemical reaction is discussed in terms of the ratio between the equivalent thicknesses of the reaction layer and diffused part of the double layer. ***L. Gierst and H. Hurwitz.*** *Zeitschrift für Elektrochemie; Berichte der*

Bunsengesellschaft für Physikalische Chemie, v. 64, no. 1, Mar. 1960, p. 36-41.

9036* Investigation Methods of Chemical Relaxation. A survey of the various relaxation methods for the study of rapid reactions in solution is presented. Changes in pressure, temperature and electric field may be employed to change the position of equilibrium. The relaxation is observed either directly as a transient process or is derived from the response of the system undergoing periodical changes. (*In German.*) Methoden zur Untersuchung chemischer Relaxation. ***L. De Maeyer.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, no. 1, Mar. 1960, p. 65-72.

See also: **8780** (type "E" F cell tank); **9398** (corrosion resistance of Ni + Cr plate); **9399** (decorative plating on Zn alloy die castings).

ELECTRONICS

9037* Model Experiments for the Electromagnetic Reflection Location (Radar) With Ultrasonic Waves (Sonar). The radar screen picture is essentially composed of signals reflected optically from plane surfaces and of scatter signals from edges. The level of scatter signals from edges was at least 30 dB below that of optical reflections. The scattered wave from an edge is only slightly changed when the adjoining surface is covered with absorbers. Screen pictures of model villages are given. (*In German.*) Modellversuche zur Elektromagnetischen Rückstrahlortung (Radar) mit Ultraschallwellen (Sonar). ***E. Meyer and P. Schnupp.*** *Acustica*, v. 10, no. 1, 1960, p. 1-13.

9038 Telebit—An Integrated Space Navigation and Communication System. An outgrowth of the STL Explorer satellite and Pioneer space probe developments, Telebit integrates tracking, command, and telemetry functions in a flexible system tailored for space exploration. ***George E. Mueller.*** *Astronautics*, v. 5, May 1960, p. 26 + 6 pages.

9039 A Solid-State UHF Radar Transponder. Used with the Millstone radar, and employed in Transit and Tiros shots, it combines lightweight and low-power requirements with the ability to provide real-time tracking and orbit determination at very long ranges. ***Lincoln Cartledge and G. Bradford Tiffany.*** *Astronautics*, v. 5, May 1960, p. 30 + 3 pages.

9040 Television Cameras for Space Exploration. Explorations of outer space will be done with the use of television, which will extend man's vision to these new frontiers without exposing his person to its dangers. Such cameras have been designed and tested to survive the space environment. ***M. H. Mesner and J. R. Staniszewski.*** *Astronautics*, v. 5, May 1960, p. 36 + 6 pages.

9041 Maser, Iraser, and Laser. Quantum electronics, in the form of low-noise amplifiers and atomic clocks, provide new tools for space and relativity experimentation. ***Harold Lyons.*** *Astronautics*, v. 5, May 1960, p. 38 + 6 pages.

9042 Space Age Electronic Materials. Search for materials to meet the demands of spaceflight moves into unexplored areas of solid-state physics and to the threshold of a new era in electronic design. ***John W. Buttrey.*** *Astronautics*, v. 5, May 1960, p. 40 + 7 pages.

9043* Solid-State Relays and Switches. Switching is basic. Here is an introduction to the new solid-state devices that are increasingly taking over this job in industry. ***D. H. Roberts.*** *Control*, v. 3, no. 23, May 1960, p. 153-155.

9044* Recent Progress in Thermoelectricity. To stimulate the development of thermoelectricity, numerous articles were prepared for Electrical Engineering by prominent representatives in this field. Some of the concepts and recent progress are reviewed in this first article. ***S. J. Angello.*** *Electrical Engineering*, v. 79, May 1960, p. 353-357.

9045* Measurement of the Parameters in the Thermoelectric Figure of Merit. Effective methods for measuring such important parameters of thermoelectric materials as Seebeck coefficient, thermal conductivity, and electrical resistivity are described. ***E. H. Lougher.*** *Electrical Engineering*, v. 79, May 1960, p. 358-364.

9046* A Thermoelectric Refrigerating System for Submarines. A general investigation of cooling capacity and performance of thermoelectric couples, the design of a refrigerating system for a large frozen stores room and a smaller chilled stores room, the determination of the performance of the entire system are discussed. ***R. G. Sickert.*** *Electrical Engineering*, v. 79, May 1960, p. 364-371.

9047* Measurement of Materials for Thermoelectric Generators. Presents the various aspects of thermoelectric generator material measurement. Engineers need to be informed not only of the "how" of measurements, but also of just what the various measurements can reveal and which ones are needed for a specific purpose. ***C. S. Duncan and G. W. Wilson.*** *Electrical Engineering*, v. 79, May 1960, p. 372-378.

9048* Thermoelectric Refrigeration. Practical thermoelectric cooling has become a reality with the development of thermoelectric semiconductor materials. Several devices which represent applications in the electronics industry and medicine are described. ***W. L. Wright.*** *Electrical Engineering*, v. 79, May 1960, p. 380-384.

9049* Electromagnetic Actuators. II. The article is taken from Chapter II of "Fluid Power Control". The named book is a basic mathematical analysis of fluid power devices, with abundant design information on hydraulic and pneumatic systems and components. ***Richard H. Frazier.*** *Electromechanical Design*, v. 4, no. 5, May 1960, p. 22-30.

9050* An Improved Recording Oximeter. Analysis of the theory of ear oximetry is given and an instrument is described which continuously solves the theoretical equation and provides a record of absolute arterial oxygen saturation. The new circuit introduces other advantages, resulting in a high degree of stability and repeatability. ***A. W. Melville, D. H. Smith, and J. B. Cornwall.*** *Electronic Engineering*, v. 32, May 1960, p. 296-300.

9051 Heat Sinks for Power Transistors. Heat transfer problems of semiconductor power devices differ from those encountered in vacuum tube techniques. Presents a simple method which enables the engineer to determine the best heat transmission path. ***Arthur F. Lohman.*** *Electronic Industries*, v. 19, May 1960, p. 83-86.

9052 Radar Tester Needs Wide Band AFC. The design considerations of a wide band AFC used in a radar target simulator are presented. ***John T. Harper and James L. Redifer.*** *Electronic Industries*, v. 19, May 1960, p. 92-95.

9053 Predicting the Antenna's Role in RFI. Through good antenna design, RFI problems can be drastically reduced. Equations given here will aid in the prediction of interference from antennas as well as facilitate calculations of other antenna parameters. ***Ernest Jacobs.*** *Electronic Industries*, v. 19, May 1960, p. 96-102.

9054 Solid Tantalum Capacitors in Timing Circuits. Reliability and reduced size are making the solid Ta capacitor increasingly attractive. In timing circuits, the designer should specify limit holding units. ***George H. Didinger.*** *Electronic Industries*, v. 19, May 1960, p. 110-113.

9055 New System Defeats Multipath Effect. The multipath problem can be minimized by sending signals that shift carrier frequency every millisecond. The shift is only a few hundred cycles and a maximum of eight shifts is required. ***George A. Scheer.*** *Electronic Industries*, v. 19, May 1960, p. 150 + 4 pages.

9056 Semiconductor Networks for Microelectronics. Selective diffusion and shaping of a semiconductor to form complete circuits reduces size and weight and improves reliability. Includes description of how a circuit is developed from a diagram to a network on and within a single-crystal semiconductor wafer.

Jay W. Lathrop, Richard E. Lee, and Charles H. Phipps. *Electronics*, v. 33, no. 20, May 13, 1960, p. 69-78.

9057 Selecting R-C Values for Active Filters. Filters characterized by no output at infinite frequency or at zero frequency can be realized with R-C circuit configuration. Symmetry of network voltage transfer function allows R-C component values to be determined by coefficient-matching technique. ***R. E. Bach, Jr.*** *Electronics*, v. 33, no. 20, May 13, 1960, p. 82-85.

9058 Signal Transmission Through Ionized Media. Nuclear-powered, rocket-powered, and space-re-entry vehicles produce ionized regions that can tangle up communications. Details of problems. ***William A. Greenhow.*** *Electronics*, v. 33, no. 21, May 20, 1960, p. 81-85.

9059 Achieving Discriminator Levels With a Biased Input Diode. Triggering thresholds of this highly accurate and stable pulse-height discriminator are set by adjusting bias of a diode. ***F. S. Goulding and L. B. Robinson.*** *Electronics*, v. 33, no. 21, May 20, 1960, p. 89-91.

9060 Method for Simplifying Filter Design. ***Kurt Lichtenfeld.*** *Electronics*, v. 33, no. 21, May 20, 1960, p. 96-99.

9061 Electronics in Japan. I. Japan: Background of the Electronics Industry. II. Products and Practices: Status of the Electronics Industry. III. Research and Engineering: Frontiers of the Electronics Technology. IV. Marketing and Export: Status of Electronics Business. Special report on growing industry, maturing technology of most active competitor of U. S. electronics. ***Frank Leary.*** *Electronics*, v. 33, no. 22, May 27, 1960, p. 53-100.

9062 Missile Communication During Reentry Blackout. Communication blackout that occurs during missile re-entry because of plasma sheath formation can be eliminated by using a sufficiently high communication frequency. ***K. M. Baldwin, O. E. Bassett, E. I. Hawthorne, and E. Langberg.*** *Electronics*, v. 33, no. 22, May 27, 1960, p. 105-109.

9063 Negative-Resistance Amplifier Design. Design criteria for negative-resistance amplifiers are given. Equations relating gain, gain-bandwidth and stability are presented, as well as experimental results. ***J. B. Schultz and H. B. Yin.*** *Electronics*, v. 33, no. 22, May 27, 1960, p. 110-112.

9064 Designing Solid-State Static Power Relays. Silicon controlled rectifiers are used in relays and circuit breakers having contact rating ranging from milliwatts to kilowatts. ***Richard F. Blake.*** *Electronics*, v. 33, no. 22, May 27, 1960, p. 114-117.

9065 Reducing Interference in Ionospheric Sounding. During back-scatter experiments, tone signals from interfering stations on the same frequency disturbed pulse reception. This Australian-designed circuit is used to separate the desired pulses from the unwanted tone signals. ***K. Perry.*** *Electronics*, v. 33, no. 22, May 27, 1960, p. 118 + 1 page.

9066 Electrons and Phonons. The theory of transport phenomena in solids. Phonons, electrons, interactions, scattering, conduction, mobility, size and surface effects, and phenomena in a magnetic field. ***J. M. Ziman.*** 554 pp. 1960. Oxford University Press, London. (QC125 Z65e)

9067* Thermoconductivity of p- and n- Germanium With Various Concentration of Current Carriers in the 80-440°K Region. Thermocouples for temperature measurement of samples were soldered to tin balls, melted in a vacuum in the side surfaces of the samples. Sketch 3 shows various laboratories obtained values of the coefficient of thermoconductivity conform well with each other. (*In Russian.*) Teploprovodnost' germaniia p-i n-tipa s razlichnoĭ kontsentratsieĭ nositeleĭ toka v oblasti temperatur 80-440°k. ***E. D. Devyatkova and I. A. Smirnov.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 561-565.

9068* On the Capture-Section of Holes in Germanium by Defects Formed by γ-Irradiation. Formulas used for the calculation are cited. The results show that the capture-sections of holes in Ge are close to each other. (*In Russian.*) K voprosu o sechenii zakhvata dyrok defektami v germanii, obrazovannymi γ-obluchemiami. ***R. F. Konopleva, S. M. Ryvkin, and I. D. Taroshetsky.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 566-568.

9069* Quantum Yield of the Cd Te—Photocells With p-n-Function in the Ultra-Violet Region of the Spectrum. Measurements of the spectral sensitiveness of a large number of Cd Te photocells were carried out to determine the multiplication of electrons by exposure of photocells to short-wave light. The excess of energy of the initial photocarriers, necessary for the impact ionization, is approximately 2 ev. (*In Russian.*) Kvantovyĭ vykhod fotoelementov s p-n perekhodom iz Cd Te v ul'trafioletovoĭ oblasti spektra. ***G. B. Dubrorsky.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 569-570.

9070* On the Influence of Thermoprocessing on the Electric Properties of p-Silicon. The samples were cut from monocrystallite ingots, obtained by pulling out from quartz crucibles with turning or by non-contact vertical zonal fusing. Multiple tests with p-type Si showed that the specific electroresistance of samples increased sharply after the quenching. A preliminary annealing at 1200 C during eight hours results in a sharp decrease of the effect of increase of the specific resistance after a successive hardening from 800 C to room temperature. (*In Russian.*) O vliianii termicheskoĭ obrabotki na elektricheskie svoĭstva kremniia p-tipa. ***I. D. Kirvalidze and V. F. Zhukov.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 571-574.

9071* Absorption of Infra-Red Radiation by Semiconductors in an Electric Field. The relation between the absorption of infrared radiation by carriers of current in nondegenerate semiconductors from the angle between the directions of polarization of the beam and the electric field is discussed. It is shown, that at $eEl \ll kT$ (where E is the field, but l the mean length of the run of the carrier) the effect is quadratic by the field. (*In Russian.*) Pogloshchenie infrakrasnogo izlucheniia poluprovodnikami v elektricheskom pole. ***N. V. Fomin.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 605-607.

9072* Investigation of Semiconducting Properties in the Si-Co System. The phase investigation of the Si-Co system was carried out by thermic, metallographic, X-ray-structural, dilatometric and magnetic methods. The four compositions of Co_3Si, Co_2Si, CoSi and $CoSi_2$ were confirmed. The compositions Co_2Si, CoSi and $CoSi_2$ are melting at a clear maximum. Co_3Si is formed by the peritectic reaction between a liquid and the composition Co_2Si. The highest values of electroconductivity were noted for $CoSi_2$. (*In Russian.*) Issledovanie poluprovodnikovykh svoĭstv v sisteme kremnĭĭkobal't. ***E. N. Nikitin.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 633-636.

9073* Electric Properties of Some Oxide Semiconducting Glasses. Electroconductivity, thermoelectromotive force, dielectric losses and dielectric penetrability of glasses of the systems V_2O_5-P_2O_5, V_2O_5-P_2O_5-BaO and WO_3-P_2O_5-K_2O were investigated. All investigated glasses are electronic semiconductors. The electroconductivity of the glasses increases with the increase of the content of oxide of a metal of the transitional group. The mechanism of the electroconductivity of glass is similar to the mechanism of the electroconductivity of crystalline oxides of the metals of the transitional group. (*In Russian.*) Elektricheskie svoĭstva nekotorykh oksidnykh poluprovodnikovykh stekol. ***V. A. Ioffe, I. B. Patrina, and I. S. Poberovskaya.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 656-662.

9074* Thermoelectronic Emission of Barium Tungstate. Compressed tablets of barium tungstate were used for the investigation. The applied apparatus, samples and results of measurement are discussed. (*In Russian.*) Termoelektronnaia emissiia vol'framata Bariia. ***A. I. Mel'nikov, A. V. Morozov, R. B. Sobolevskaia, and A. R. Shul'man.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 704-708 + 1 plate.

9075* Melted Quartz as a Model Material in Measurements of Thermoconductivity. The values of the coefficient of heat conductivity of melted quartz, obtained on three experimental units, coincide in the range of accuracy of measurements. To the same degree they coincide with the results obtained in the labs of Britain and USA (on five experimental units). (*In Russian.*) Plavlenyĭ kvarts kak obraztsovyĭ material pri izmerenii teploprovodnosti. ***E. D. Deviatkova, A. V. Petrov, I. A. Smirnov, and B. Ia. Moĭzhes.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 738-744.

9076* The Entrainment of the Polarization by the Rotation of a Quadratic Waveguide. This is independent of the angle and manner of the twist. The coupling into the other

polarization depends only on the angle of rotation between input and output cross-section. For one degree the coupling ratio is 37dB. (*In German.*) Die Mitführung der Polaisation bei der Verwindung eines quadratischen Hohlleiters. ***K. Schnetzler.*** *Frequenz*, v. 14, Apr. 1960, p. 123-126.

9077* Low-Noise Tunnel-Diode Down Converter Having Conversion Gain. Describes the use of the new tunnel diode in a down converter. An experimental UHF circuit converting from a signal frequency of 210 mc to an intermediate frequency of 30 mc is used to illustrate the feasibility of this new converter. Conversion power gain of 22 db with less than 3 db noise has been achieved with gallium arsenide diodes. ***K. K. N. Chang, G. H. Heilmeier, and H. J. Prager.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 854-858.

9078* Noise Limitations to Resolving Power in Electronic Imaging. It is found both theoretically and experimentally that the masking effect of white noise depends only on the noise power per unit bandwidth, and is independent of the upper frequency limit of the noise spectrum, provided that this exceeds the frequency limit set by the eye. ***J. W. Coltman and A. E. Anderson.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 858-865.

9079* Packaged Tunable L-Band Maser System. A low-noise tunable *L*-band maser system is described. The maser uses a pink ruby crystal oriented at 90° and is tunable from 850 to 2000 mc. An *L*-band circulator was developed for use with the maser. The maser and circulator were packaged into an operational unit. ***F. R. Arams and S. Okwit.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 866-874.

9080* Cadmium Sulfide Field Effect Phototransistor. The experimental evaluation of cadmium sulfide field effect transistors indicates that, although the material does not compete with Ge for general transistor application, useful power gain was achieved and certain advantages exist for CdS in phototransistor applications. ***R. R. Bockemuehl.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 875-882.

9081* A Broad-Band Cyclotron Resonance RF Detector Tube. A tube is described which utilizes the cyclotron motion of electrons to provide a resonant system which is tuned by variation of the magnetic flux density. ***Franklin M. Turner.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 890-897.

9082* Anomalies in the Absorption of Radio Waves by Atmospheric Gases. Summarizes recent measurements of the attenuation of radio waves by atmospheric gases and compares the measured losses with those predicted by Van Vleck. ***A. W. Straiton and C. W. Tolbert.*** *I.R.E. Proceedings*, v. 48, May 1960, p. 898-903.

9083 Calibration and Rating of Microphones. Calibration of a microphone consists of measuring its response to some known characteristic of a sound field under specified conditions. Usually the open circuit voltage for a one-microbar sound pressure is determined. Complete calibration includes measurements of directivity and impedance as well as linearity of response. ***William B. Snow.*** *IRE Transactions on Audio*, v. AU-8, no. 1, Jan.-Feb. 1960, p. 5-13. (TK1 In6.6au Vis.)

9084 Stereophonic Projection Console. A system is described for home stereophonic reproduction from a single cabinet by reflection of sound from the room boundaries. The effect is emphasized by using loudspeakers which maintain a uniform cardioid directional pattern over the useful frequency range. ***B. B. Bauer and G. W. Sioles.*** *IRE Transactions on Audio*, v. AU-8, no. 1, Jan.-Feb. 1960, p. 13-16. (TK1 In6.6au Vis.)

9085 A Transistorized Stereo Preamplifier and Tone Control for Magnetic Cartridges. RIAA equalization with ± 4 db bass control and ± 8 db treble control have been achieved, along with negligible hum, noise and distortion, in a transistorized stereo preamplifier developed for use with magnetic cartridges. Simple circuit modifications adapt this preamplifier for use with most magnetic cartridges ***Alexander B. Bereskin.*** *IRE Transactions on Audio*, v. AU-8, no. 1, Jan.-Feb. 1960, p. 17-20. (TK1 In6.6au Vis.)

9086 Bandwidth Compression by Means of Vocoders. In the vecoder the powder spectrums is analyzed and synthesized by means of band-pass filters. The energy for the voiced sounds is obtained from an oscillator called a buzz source, and for the fricative consonants the energy is obtained from a white noise source. ***Frank H. Slaymaker.*** *IRE Transactions on Audio*, v. AU-8, no. 1, Jan.-Feb. 1960, p. 20-26. (TK1 In6.6au Vis.)

9087 Design and Use of RC Parallel-*T* Networks. The use of the parallel-*T* as a low pass or a high pass is covered briefly, and it is shown how a net of more complexity can be derived to give an improvement in response. Using the symmetrical lattice equations, typical examples are worked out. The resulting networks are usually three *T* nets in parallel, or a triple-*T*. ***Gifford White.*** *IRE Transactions on Audio*, v. AU-8, no. 1, Jan.-Feb. 1960, p. 26-33. (TK1 In6.6au Vis.)

9088 A Transistorized Portable Television Receiver. A schematic for receiver chassis and for tuner chassis are cited. ***A. R. Curll.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 9-16. (TK1 In6.6b Vis.)

9089 A Transistor TV I-F Amplifier. Design requirements, emitter follower, detector, final I-F amplifier, automatic gain control and neutralization are discussed. ***John G. Humphrey.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 17-20. (TK1 In6.6b Vis.)

9090 Designing Solar Power Supplies for Transistorized Radio Receivers. Basic characteristic of solar cells, equivalent circuit of cell assembly, rechargeable battery and transistor radio, charging action, financial considerations. ***Jerome Kalman.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 21-24. (TK1 In6.6b Vis.)

9091 The Video Processing Circuits of an All Transistor Television Receiver. The transistor requirements for these circuits are discussed and recommended transistors and circuits are shown. ***C. D. Simmons and C. R. Gray.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 25-32. (TK1 In6.6b Vis.)

9092 Transistorized Vertical Scan System for Magnetic Deflection. Scans a 90-degree, 14-inch picture tube at 14 KV accelerating voltage. Consists of two transistors in a common-emitter multivibrator to form a vertical oscillator, one transistor as a driver and one output transistor. ***Fuad L. Abboud.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 33-38. (TK1 In6.6b Vis.)

9093 Linearization of a Transistorized Vertical Deflection System. This investigation involves the study of the linearity problems associated with a two transistor vertical deflection system. The results of this investigation lead to a passive feedback type coupling network that is analyzed and offered as a practical solution to the linearity error problem. ***R. B. Ashley.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 39-47. (TK1 In6.6b Vis.)

9094 Improvement of Picture Quality by Means of Beam Spot Stretch. As a method of eliminating the dark line caused by the scanning spots on the TV kinescope, the spot stretch method is adopted for this experiment. The method, in concrete, can be achieved by attaching the focus magnet to the exterior surface of the CRT neck portion and utilizing the axial asymmetrical astigmatism caused by its magnet. ***Hiroshi Kogo, Hiro Nakatsukasa, and Taro Kawase.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 48. (TK1 In6.6b Vis.)

9095 Mixer-Oscillator Considerations for Nuvistors in the VHF Band. This paper touches briefly on the general theory of mixer operation and on considerations leading to the choice of a particular type of frequency changer. The Nuvistor tetrode's advantages are low injection voltage, higher input impedance, small size. ***Cambell Gonzalez.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 49. (TK1 In6.6b Vis.)

9096 Performance of Nuvistor Small-Signal Tetrodes in Television Video if Amplifiers. Three and two stage Nuvistor tetrodes were constructed and tested. This tube is most desirable in compact modern receiver design. ***W. H. Mead.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 1, May 1960, p. 50. (TK1 In6.6b Vis.)

9097 Inverse Ionosphere. Describes the distortion introduced into a long-range communication system by unpredictable multipath conditions of the ionosphere. A device to eliminate this particular form of distortion is described, using a sensing technique, a logical matrix, and a signal restoration network. ***George D. Hulst.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 3-9. (TK1 In6.6cs Vis.)

9098 Optimum Antenna Height for Ionospheric Scatter Communication. Radiation patterns of elevated antennas over spherical earth for scatter propagation in the lower ionosphere incorporating refraction, parallax, spherical divergence, tropospheric defocusing, and near-horizon diffraction have been used to compute the height gain function resulting from raising and lowering symmetric transmitting and receiving antennas for a fixed path length. ***R. G. Merrill.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 14-19. (TK1 In6.6cs Vis.)

9099 Results From a Three-Hop Tropospheric Scatter Link in Norway With Parallel Operations on 900 mc and 2200 mc. From measurements on a 360-km hop, it is concluded that (1) the monthly amplitude distributions are approximately Gaussian, and the one-minute amplitude distributions are approximately of the Rayleigh type. and (2) the signals are generally considerably stronger (differences up to the order of 10 db) in summer than in winter. ***N. H. Knudtzon and P. E. Gudmandsen.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 20-26. (TK1 In6.6cs Vis.)

9100 Performance of a 640-Mile, 24-Channel UHF—SSB Experimental Communication System. A mock-up communication has been installed between Westford, Mass., and Winston-Salem, N. C., providing a 640-mile path as a test circuit to measure performance of a 24-channel UHF-SSB system. The equipment is described. ***Burt E. Nichols.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 26-33. (TK1 In6.6cs Vis.)

9101 Analysis of the Performance of the Edmonton-Yellowknife Janet Circuit. Trials of the Canadian Janet B system were carried out on an auroral zone circuit. The July, 1958, trials revealed the vulnerability of the system to polar blackout at these frequencies and to excessive error rates with rapidly fluctuating auroral signals. ***J. H. Crysdale.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 33-40. (TK1 In6.6cs Vis.)

9102 Data Transmission Tests on Tropospheric Beyond-the-Horizon Radio System. Presents results of data transmission tests made on both single-link and multilink tropospheric beyond-the-horizon radio systems. Tests were made at 750 or 1300 bits per second employing both double sideband AM and FM methods of data modulation. ***F. E. Willson and W. A. Runge.*** *IRE Transactions on Communication Systems*, v. CS-8, no. 1, Mar. 1960, p. 40-43. (TK1 In6.6cs Vis.)

9103 A Frequency Stepping Scheme for Overcoming the Disastrous Effects of Multipath Distortion on High-Frequency FSK Communication Circuits. Describes an experimental system that was produced by modifying conventional FS keyers and employing standard communications receivers in conjunction with appropriate frequency stepping means and selective filters. ***Arthur R. Schmidt.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 44-47. (TK1 In6.6cs Vis.)

9104 Transmitter Power Control in Two-Way Communications System. Feedback control is applied to high reliability systems to vary the transmitted power as a function of the fading and consequently to reduce operating cost by conserving transmitted power, and to reduce interference to other radio networks in the area. ***G. S. Axelby and E. F. Osborne.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 48-56. (TK1 In6.6cs Vis.)

9105 The Sum of Log-Normal Probability Distributions in Scatter Transmission Systems. In many important communication systems the noise power of a radio jump, or hop, has log-normal statistical distribution. In a multihop system, the noise power of each hop contributes to the total noise. The resulting noise of the system is therefore the statistical sum of the individual noise distributions. ***Lawrence F. Fenton.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 57-67. (TK1 In6.6cs Vis.)

9106 Intermodulation Distortion and Efficiency Analysis of Multicarrier Repeaters. The range of acceptable distortion is determined by the intended application and in turn determines an efficiency range. This paper will obtain relationships between distortion or efficiency and input power for a third-degree nonlinearity. ***F. Assadourian.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 68-71. (TK1 In6.6cs Vis.)

9107 Constant-Ratio Code and Automatic-RQ on Transoceanic HF Radio Services. The 7-unit form of basic constant-ratio code is given, and its advantages explained; indicative values of improvement are tabulated. A general description of the Automatic-RQ method and system—rather than specific designs—is given. ***John B. Moore.*** *IRE Transactions on Communications Systems*, v. CS-8, no. 1, Mar. 1960, p. 72-75. (TK1 In6.6cs Vis.)

9108 Broad-Band Coaxial Choked Coupling Design. Equations and curves are presented to predict the frequency bandwidth of coaxial choke couplings in terms of the choke parameters. Choke couplings discussed are those applicable to rotary joints and dc isolation units. ***H. E. King.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 132-135. (TK1 In6.6mt Vis.)

9109 A Study of Multielement Transmission Lines. Proposes a solution to the general equations which relate the voltage difference between the lines and the mesh current. Under particular conditions, it is shown that only a single type of propagating mode exists. In this case, the solution has been obtained by the so-called "decomposition method," i.e., assuming several virtual two element transmission lines in lieu of the existing multielement transmission line. ***Hiroshi Kogō.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 136-142. (TK1 In6.6mt Vis.)

9110 Measurement of Relative Phase Shift at Microwave Frequencies. ***C. A. Finnila, L. A. Roberts, and C. Süsskind.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 143-147. (TK1 In6.6mt Vis.)

9111 Resonant Modes in Waveguide Windows. Analysis and experimental verification of a class of resonant fields, called ghost-modes, occurring in waveguide dielectric windows. Numerical solutions for a simple geometry are given through universal curves. ***M. P. Forrer and E. T. Jaynes.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 147-150. (TK1 In6.6mt Vis.)

9112 Temperature Compensation of Coaxial Cavities. A technique for temperature compensation of coaxial cavities by controlling the capacitance between the end of the center conductor and an end plate across the outer conductor is described. A formula is derived for this capacitance which is verified experimentally. ***J. R. Cogdell, A. P. Deam, and A. W. Straiton.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 151-155. (TK1 In6.6mt Vis.)

9113 A Graphical Method for Measuring Dielectric Constants at Microwave Frequencies. A graphical method for measuring the real and imaginary parts of the dielectric constant $\epsilon/\epsilon_0 = \epsilon' - j\epsilon''$ of materials at microwave frequencies is described. The method is based on the network approach to dielectric measurements proposed by Oliner and Altschuler in which the dielectric sample fills a section of transmission line or waveguide. ***Charles B. Sharpe.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 155-159. (TK1 In6.6mt Vis.)

9114 Wide-Band Strip-Line Magic-T. Presents theoretical performance calculations of a novel form of wide-band strip-line Magic-T that uses two dual strip-line band-pass filters. ***E. M. T. Jones.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 160-168. (TK1 In6.6mt Vis.)

9115 A General Theorem on an Optimum Stepped Impedance Transformer. Shows how this theorem places very severe limitations on any effort to improve on the performance of a quarter-wave transformer by increasing the number of its impedance steps without a corresponding increase in its length.

Henry J. Riblet. *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 169-170 (TK1 In6.6mt Vis.)

9116 Complementarity in the Study of Transmission Lines. The principle of complementarity is applied to the slot transmission line. The properties of a dual circuit are investigated. The pairs of several possible duals for a given configuration are correlated. ***G. H. Owyang and Ronold King.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 172-181. (TK1 In6.6mt Vis.)

9117 High Resolution Millimeter Wave Fabry-Perot Interferometer. The design and operation of a microwave Fabry-Perot interferometer at wavelengths around 6 mm is described. This uses reflectors which are simple, easy to make, and which are capable of scaling for operation at short wavelengths in the ultramicrowave region. With power reflection coefficients around 0.999, very sharp fringes and Q values around 100,000 were obtained on the interferometer. Effects of diffraction in the interferometer are considered, also wavelength measurements with this particular interferometer. ***William Culshaw.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 182-189. (TK1 In6.6mt Vis.)

9118 Boundary Conditions and Ohmic Losses in Conducting Wedges. A "modified" surface impedance condition, which can be applied to wedge problems in which the perfectly conducting solution is known, is developed. ***Robin M. Chisholm.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 189-198. (TK1 In6.6mt Vis.)

9119 On the Theory of the Ferrite Resonance Isolator. The attenuation constants for both directions of propagation in a rectangular waveguide loaded with a small slab of ferrite are calculated by means of perturbation theory. The maximum attainable ratio of reverse to forward attenuation is found to be inversely proportional to the square of the bandwidth. ***E. Schlömann.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 199-206. (TK1 In6.6mt Vis.)

9120 Analysis of Microwave Measurement Techniques by Means of Signal Flow Graphs. Reviews the method of setting up flow graphs of microwave networks and the rule for their solution. A single directional-coupler reflectometer system for measuring the reflection coefficient of a load is then analyzed by this method. ***J. K. Hunton.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 206-212. (TK1 In6.6mt Vis.)

9121 Stepped Transformers for Partially Filled Transmission Lines. Presents a generalized outline for determining the approximate effective guide wavelength and characteristic impedance of two types of partially-filled transmission line. The results are used to determine the geometries required for the design of optimum stepped transmission line transformers. ***D. J. Sullivan and D. A. Parkes.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 212-217. (TK1 In6.6mt Vis.)

9122 Parametric Diodes in a Maser Phase-Locked Frequency Divider. Describes a divider which uses no microwave tubes and hence one that can be transistorized; and an ammonia-maser-controlled signal generator used to tune up the divider. ***M. L. Stitch, N. O. Robinson, and W. Silvey.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 218-221. (TK1 In6.6mt Vis.)

9123 Parametric Devices and Masers: An Annotated Bibliography. ***E. Mount and B. Begg.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-8, no. 2, Mar. 1960, p. 222-243. (TK1 In6.6mt Vis.)

9124 Energy Spectra of FM System With Low Beta, High Deviation Ratio, and MF Which Approaches Carrier Frequency. A technique was developed at the Naval Air Missile Test Center to determine energy spectra of an FM system which has a low Beta, a high deviation ratio, and a modulation frequency which approaches the carrier frequency. ***Sheldon L. Simmons.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-6, no. 1, Mar. 1960, p. 17-19. (TK1 In6.6r Vis.)

9125 How Environment Affects Magnetic Recording Tape. The increasing emphasis on higher and higher operating and/or storage temperatures for data acquisition apparatus requires a critical appraisal of the behavior of available magnetic recording tapes as their rated operating limits are approached or exceeded. Critical temperatures and observed effects are described. ***Clarence B. Stanley.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-6, no. 1, Mar. 1960, p. 19-24. (TK1 In6.6r Vis.)

9126 Threshold Improvement in an FM Subcarrier System. The effect of additional output filtering following the ideal phase-coherent loop is discussed. The requisite modulation characteristics for an improved threshold in a phase-locked loop discriminator are presented, followed by a brief description of the approaches which may be taken in the design of such a system. ***Benn D. Martin.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-6, no. 1, Mar. 1960, p. 25-33. (TK1 In6.6r Vis.)

9127 A Versatile PAM/PDM Decommutation Station. The growing complexity of data-handling systems and the need for less complicated and smaller decommutation devices led to the development of the PAM/PDM decommutation station. ***J. A. Adams and W. T. Johnston.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-6, no. 1, Mar. 1960, p. 38-40. (TK1 In6.6r Vis.)

9128 Ground Antenna for Space Communication System. The TRAC(E) system developed by the Jet Propulsion Laboratory utilizes an 85-foot-diameter, equatorially mounted, parabolic reflector. The mechanical and electrical characteristics of the antenna and its sub-systems are discussed, and its performance and the way it was used in tracking the lunar probe Pioneer IV are described. ***K. W. Linnes, W. D. Merrick, and R. Stevens.*** *IRE Transactions on Space Electronics and Telemetry*, v. SET-6, no. 1, Mar. 1960, p. 45-54. (TK1 In6.6r Vis.)

9129* Introduction to the Tecnetron Theory. The tecnetron is a semiconductor amplifying device. It uses the centripetal striction produced by the field effect in a cylindrical structure. Its analysis is divided into two parts. Part one establishes the approximative fundamental theory and deduces the principal characteristics of the device, as well as some practical conclusions. Part two deals with secondary effects and their bearing on the fundamental theory and the practical design of the device. (*In French.*) Introduction a la théorie du tecnetron. ***A. V. J. Martin.*** *Journal de Physique et le Radium*, (Suppl.), v. 21, no. 3, Mar. 1960, p. 24A-36A.

9130* Ferrite Tuning of Reflex Klystrons. Experimental results on the ferrite tuning of the reflex klystrons CV2164 and CV2346 are given and the relation between valve parameters and expected tuning ranges is discussed. ***P. E. V. Allin.*** *Journal of Electronics and Control*, v. 7, no. 5, Nov. 1959, p. 377-392.

9131* The Poisoning of Impregnated Cathodes. O_2, water vapor, CO_2 and air poison barium-calcium aluminate cathodes while CO, N_2 and H_2 do not. Poisoning takes place with the former gases if a critical pressure, depending on the gas, is exceeded, this pressure increasing with cathode temperature. ***R. O. Jenkins and W. G. Trodden.*** *Journal of Electronics and Control*, v. 7, no. 5, Nov. 1959, p. 393-415.

9132* Some Solutions to the Equations of Steady Space Charge Flow in Magnetic Fields. The equations for steady, laminar, space charge flow are set up. Sets of particular solutions in prescribed magnetic fields are presented—even when the magnetic field has components perpendicular to the cathode. ***P. T. Kirstein.*** *Journal of Electronics and Control*, v. 7, no. 5, Nov. 1959, p. 417-422.

9133 Laplace Transforms for Electronic Engineers. Functions of complex variables, the Fourier series and integrals, the Laplace transformation, the inverse Laplace transformation, Laplace transform theorems, network analysis by means of the Laplace transformation, transforms of special waveshapes and pulses, specialized applications of the Laplace transform are discussed. ***James G. Holbrook.*** v. X. 259 pp. 1959. Pergamon Press, New York. (QA432 H69L)

9134 Masers. Outlines methods used to obtain conditions necessary for amplification; describes its effects of various physical processes on amplifier efficiency, and on the effective

frequency response of a molecular transition used to amplify; derives gain, bandwidth, and noise factor of this traveling wave line type of stimulated emission amplifier, and of the resonant cavity type of amplifier. ***Gordon Troup.*** 168 pp. 1959. John Wiley & Sons, New York. (TK7872.M45 T75m)

9135 Photoelectric Determination of the Electron Work Function of Indium. The photoelectric work function of evaporated In films prepared in ultra-high vacuum is found to be 4·08 ± 0·01 eV. ***J. van Laar and J. J. Scheer.*** *Philips Research Reports*, v. 15, no. 1, Feb. 1960, p. 1-6.

9136 Investigations Into Redundancy and Possible Bandwidth Compression in Television Transmission. III. Transmission Systems With Bandwidth Compression. Reviewing the development of color television, we can conclude that the transmission problem has been solved in a very satisfactory way. Up to now, the display technique employed in the R. C. A. tricolor picture tube is the only one which is being employed in large-scale production of color television receivers. ***K. Teer.*** *Philips Research Reports*, v. 15, no. 1, Feb. 1960, p. 30-96.

9137 Experimental Investigation of Conduction Band of GaSb. The conduction band of GaSb was investigated by making the following measurements of a number of *n*-type samples with different carrier concentrations: (1) Hall effect and conductivity between 1.5 K and 370 K; (2) the change of resistance and Hall effect of the samples under hydrostatic pressure (up to 14 x 10^9 dynes/cm^2) at room temperature; and (3) the change of resistance due to uniaxial stress between 77 K and 370 K. ***A. Sagar.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 93-100.

9138 Development of Space Charge and Growth of Ionization in the Transient Townsend Discharge. By using the general formulas derived from the analysis in a previous paper, calculations are made of the development of electronic and ionic space charges, the growth of space-charge-distorted field, the buildup of current, and the grain in ionization integral due to the field distortion in the transient Townsend discharge. ***Yasunori Miyoshi.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 355-365.

9139 Radio Emission by Plasma Oscillations in Nonuniform Plasmas. Equations of motion for small-amplitude plasma oscillations interacting with the electromagnetic field in slowly varying density or temperature gradients are set up. We then make a calculation of the radio noise excited by a wave packet of plasma oscillations traversing such gradients using the WKB approximation. A similar calculation is also made for a density discontinuity. ***D. A. Tidman.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 366-374.

9140 Wave Functions and Effective Hamiltonian for Bloch Electrons in an Electric Field. The wave functions are Houston modifications of Bloch type functions; the Bloch functions from an orthogonal set whose members are fully determined except for phase. The theory exhibits them in the form of power series in the field strength; the unmodified Bloch band functions form the zero order term of that series. ***Gregory H. Wannier.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 432-439.

9141 Elastic Modulus of Isotopically-Concentrated Lithium. The elastic modulus of lithium-6 (96.1% Li^6, 3.9% Li^7, was found to be (7.93 ± 0.21 x 10^{10} dynes/cm^2, and that of lithium-7 (7.5% Li^6, 92.5% Li^7) (7.98 ± 0.33) x 10^{10} dynes/cm^2. ***W. M. Robertson and D. J. Montgomery.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 440-442.

9142 Theory and Application of Thermally Stimulated Currents in Photoconductors. The theory of thermally stimulated currents is investigated in the limits of slow and fast retrapping. A method of obtaining the ionization energy E of the relevant traps is discussed. This method depends on the shift of the conductivity maxima with heating rate and does not involve prior knowledge of the trapping cross sections or of the heating rate. ***Rudolph R. Haering and Edward N. Adams.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 451-454.

9143 Range of 1—10 kev Electrons in Solids. The range of 1-10 kev electrons in metals and phosphors has been measured by recording the light output as a function of energy from a sample consisting of a metallic layer deposit on a transparent phosphor layer. The measurements lead to the development of the following range-energy expression: $R = 250(A/pZ^{n/2})E^n$, where $n = 1.2/(1-0.29 \log_{10}Z)$, E = energy in kev, R = range in angstroms, and A, p, Z, have their customary meaning. ***Charles Feldman.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 455-459.

9144 Crystal Potential and Energy Bands of Semiconductors. II. Self-Consistent Calculations for Cubic Boron Nitride. A self-consistent crystal potential is constructed. Exchange is included according to the Slater free-electron approximation. The effect of the heteropolar character of the potential is included explicitly in an approximately self-consistent treatment of the valence-electron charge density. The energy gap is found to be about twice that of diamond, consistent with the results of other zincblende crystals and their diamond-type analogs. ***Leonard Kleinman and James C. Phillips.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 460-464.

9145 Drift Velocity of Electrons in Helium. The drift velocity of electrons in He at 300 K has been measured for E/p values between 4 x 10^{-1} and 40 volt/cm-mm Hg. The data for $E/p < 1$ volt/cm-mm Hg were obtained from measurements of electron transit time in a modernized version of the double shutter tube developed by Bradbury and Nielsen. The data at high E/p were obtained from microwave measurements of the electron density in a positive column of a low-pressure discharge. ***A. V. Phelps, J. L. Pack, and L. S. Frost.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 470-474.

9146 Photoelectric Effect in Pb at High Energies. A formula for the photoelectric absorption cross section for the K shell is derived using the Furry or Sommerfield-Maue approximate wave function. The surviving terms at the high-energy limit are given explicitly and the value for the cross section is found for Pb by numerical integration. ***R. H. Boyer.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 475-478.

9147 Infrared Properties of Gold in Germanium. Lifetime studies on *n*-type samples show the existence of a 0.018-ev Coulomb barrier at singly charged sites and an indication that a thermal (phonon) mechanism is involved in the electron capture process. The lifetime also manifests itself in the noise spectrum. The photoconductive absorption cross section at 80 K of *p*-type gold-doped germanium (0.15-ev level) is found to be 2 x 10^{-16} cm^2 at 1.8 microns. ***L. Johnson and H. Levinstein.*** *Physical Review*, v. 117, 2nd ser., no. 5, Mar. 1, 1960, p. 1191-1203.

9148 Proceedings of the National Electronics Conference. Volume XV. Adaptive servomechanisms, parametric amplification, audio, communication systems, computers, electronic devices, automatic control, perception and recognition, low noise devices, information theory, numerical analysis and switching theory, engineering management, solid-state circuits, communication systems, modern production techniques, magnetic amplifier applications and other problems are discussed. ***C. H. Hoffmann, editor, et al.*** 1089 pp. 1959. National Electronics Conference Inc., Chicago. (TK161 N21p Vis.)

9149 Pneumatics Simulates Electronics. Now for the first time, using the pneumatic thyratron as an example, here is a dimensional analysis of all the essential units—potential, flow, power, resistance, capacitance—needed in actual applications. ***Phillip M. Connaught.*** *Product Engineering*, v. 31, no. 19, May 9, 1960, p. 39-42.

9150 Progress in Semiconductors. Negative effective masses in semiconductors, oxidation phenomena on Ge surfaces, theory of avalanche multiplication in nonpolar semiconductors, internal field emission, noise in semiconductors, the electrical effects of dislocations in semiconductors, dielectric properties of solids, noncrystalline, amorphous and liquid electronic semiconductors are discussed. ***Alan F. Gibson, R. E. Burgess, and F. A. Kröger, editors.*** v. IV. 291 pp. 1960. John Wiley & Sons, New York. (Tk3376 P94 Vis.)

9151* Problems of the Potential Interference-Killing Feature During Signal Fadings. Rules for testing a single coherent and incoherent reception on an ideal receiver of discrete communications during fluctuation noises and rapid smooth

signal fadings were obtained. The amount of probability of the signal envelope reaching the receiver is supposed to be distributed according to the general principle of Rayleigh. For some classes of systems a minimal probability of the faulty reception is calculated. (*In Russian.*) Voprosy potentsial'noĭ pomekhoustoĭchivosti pri zamiraniiakh signala. ***D. D. Klovskiĭ.*** *Radiotekhnika,* v. 15, no. 5, May 1960, p. 17-25.

9152* Calculation of the Time Constant of the Circuit of a Self-Bias in a Clipper-Limiter Circuit. Methods for the selection of a time constant of the discharge circuit of an automatic bias in systems of very simple clipper limit circuits were studied. (*In Russian.*) Raschët postoiannoĭ vremeni tsepi avtomaticheskogo smeshcheniia v amplitudnom selektore. ***A. Ia. Kornienko.*** *Radiotekhnika,* v. 15, no. 5, May 1960, p. 47-54.

9153* Optimal Phase Methods of Signal Detection. Optimal procedures were determined in order to select the phase of an assumed signal for the detection of a useful signal covered by noises. A case of detection of a determined and fluctuating signal was examined. Expressions were given for the probabilities of spurious alarms and of the correct detection. (*In Russian.*) Optimal'nye fazovye metody obnaruzheniia signalov. ***B. R. Levin.*** *Radiotekhnika i Elektronika,* v. 5, no. 4, Apr. 1960, p. 537-543.

9154* Intercorrelation of the Output Noise Voltages of Amplifiers With Over-Lapping Frequency Characteristics. The correlation of the instantaneous values of the voltages of the noises and of their envelopes, and simultaneous distribution of the envelopes at the output of two channels according to given frequency characteristics and the energy spectrum of the noises at the entrance, were determined by a spectral method. (*In Russian.*) Vzaimnaia koreliasiia napriazhenii shumov na vykhode usilitelei s perekryvaiushchimisia chastotnymi kharakteristikami. ***Iu. B. Cherniak.*** *Radiotekhnika i Elektronika,* v. 5, no. 4, Apr. 1960, p. 551-561.

9155* Approximate Solution of an Equation for the Phase of an Oscillator Influenced by an External Force. Expressions were obtained for determining the phases of oscillations of the autogenerator with amplitude, frequency and amplitude-frequency modulations of an external electromotive force, during the slow change of the modulating function. (*In Russian.*) K voprosu o priblizhennom reshenii uravneniia fazy kolebaniĭ lampovogo avtogeneratora, nakhodiashchegosia pod deĭstviem vneshneĭ EDS. ***A. N. Shusterovich.*** *Radiotekhnika i Elektronika,* v. 5, no. 4, Apr. 1960, p. 568-577.

9156* Signal Distortions in Delay Lines. An asymptotic solution of the problem of the distortion of impulses in catenary delay lines. The cases of video impulses, radio impulses and impulses with a linearly changing charge frequency were examined. Solutions were obtained in the form of asymptotic lines and graphics. A solution was generalized for the arbitrary line of transmission with dispersion properties. (*In Russian.*) Iskazheniia signalov v liniiakh zaderzhki. ***D. E. Vakman.*** *Radiotekhnika i Elektronika,* v. 5, no. 4, Apr. 1960, p. 621-632.

9157 Telemetering Systems. Current systems of telemetering, voltage systems of telemetering, frequency systems of telemetering, position systems of telemetering, impulse systems of telemetering, telemetering pickups, links and channels, and other problems are discussed. ***Perry A. Borden and Wilfrid J. Mayo-Wells.*** 349 pp. 1959. Reinhold Publishing Corp., New York. (TK399 B64t)

9158* A Theory of Radar Scattering by the Moon. A theory is described in which the moon is regarded as a "quasi-smooth" scatterer at radar frequencies. A scattered pulse is then composed of a number of individual returns each of which is provided by a single scattering area. In this manner it is possible to account for all the major features of the pulse, and the evidence in favor of the theory is presented. ***T. B. A. Senior and K. M. Siegel.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 217-229.

9159* A Theory of Wavelength Dependence in Ultrahigh Frequency Transhorizon Propagation Based on Meteorological Considerations. Recent radio data indicate that the wavelength dependence of ultrahigh frequency transhorizon propagation varies widely in time. This is in contradiction with theoretical explanations previously set forth. A new model is developed for the structure of refractive index fluctuations induced by turbulence. ***Ralph Bolgiano, Jr.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 231-237.

9160* A Preliminary Study of Radiometeorological Effects on Beyond-Horizon Propagation. High hourly median field strengths were observed in Japan corresponding to the existence of a marked refractive index discontinuity layer in a common volume of two antenna beams. The results of these experiments suggest that laminar structures of the atmosphere play an important role in beyond-horizon radio propagation. ***F. Ikegami.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 239-246.

9161* An Analysis of Propagation Measurements Made at 418 Megacycles Per Second Well Beyond the Radio Horizon (a Digest). During an 18-month period in 1952 and 1953, transmission loss measurements at 418 megacycles were made over a 134-mile path between Cedar Rapids, Iowa, and Quincy, Illinois. Continuous recordings made simultaneously at several receiving antenna heights from 30 to 665 feet yielded information on diurnal and seasonal variations in both the hourly median basic transmission loss and in height gain. ***H. B. Janes, J. C. Stroud, and M. T. Decker.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 255-257.

9162* On the Calculation of the Departures of Radio Wave Bending From Normal. The calculation of non-normal tropospheric bending of radio waves is treated in terms of a reduced-to-sea-level value of the refractive index. This method emphasizes departures of bending from the average bending for the United States and consists of visualizing ray bending as consisting of two parts; an "average" component and a "departure-from-average" component. ***B. R. Bean and E. J. Dutton.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 259-263.

9163* On the Mode Theory of Very-Low-Frequency Propagation in the Presence of a Transverse Magnetic Field. The effect of a purely transverse horizontal magnetic field on the propagation of very-low-frequency (vlf) waves is considered. It is shown that the magnetic field introduces nonreciprocity. ***D. D. Crombie.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 265-267.

9164* Response of a Loaded Electric Dipole in an Imperfectly Conducting Cylinder of Finite Length. Analytical relationships are developed which permit calculation of the power in the load impedance of an electric probe, symmetrically located within an imperfectly conducting cylinder of small radius compared to the wavelength, in terms of the electric field incident upon the cylinder. ***Charles W. Harrison, Jr., and Ronold W. P. King.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 289-293.

9165* Impedance Characteristics of a Uniform Current Loop Having a Spherical Core. The radiation impedance is derived by the electromotive force method in a convenient form as the sum of the self-radiation impedance of a loop in the free space and an additional term due to the reaction between the loop and the sphere. ***Saburo Adachi.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 64D, no. 3, May-June 1960, p. 295-299.

9166 Vacuum Valves in Pulse Technique. Basic theory of switching, application of the theory to simple switching circuits, simple treatment of electron tubes as switches, some elements of the operational calculus, fundamental treatment of electron tubes as switching elements, the multivibrator family, blocking-oscillator circuits are discussed. ***P. A. Neeteson.*** 2nd Rev. Ed. 195 pp. 1959. MacMillan Co., New York. (TK7835 N29v2)

See also: **9744** (alkyd coatings).

ENGINEERING ECONOMICS

9167 Energy. Needs Are Rising and Sources Are Shifting—Outlook to Year 2000. Surveys the situation of the chemical process industries in North America based, generally, on past performance. Discusses the struggle between coal and petroleum products to dominate the market in the face of ever increasing demands. This means that all the currently used energy sources will be increasingly tapped. But in the next 15-20 years, at least, the burden of growth will be borne by oil and natural gas. Hydroelectric capacity will be steadily increased, but it will gradually lose some of its share of the total energy market. Coal will continue to hold its own. Sometime after 1975, nuclear energy will make itself felt. After 1980, petroleum sources will start to diminish in relative importance until the year 2000, when nuclear energy and coal will together supply more than half the energy consumed. Growth figures are based on the assumption of a 3% annual increase until 1980, then a 1.5% annual growth until 2000. This is a critically weighted average of a group of recent authoritative estimates. Economic effects of foreign oil imports, natural gas "dumping", and government regulation are considered. The factor that makes firm predictions impossible, however, is the rate of technological progress. Some of the "exotic" (e.g., fuel cells, magnetohydrodynamic, thermoelectric, or thermionic devices) means of generating electricity could disrupt the entire energy outlook. *Chemical Week*, v. 86, no. 20, May 14, 1960, p. 63 + 15 pages.

9168 Copper Costs and Prices: 1870-1957. A brief view of investment and competition, periods of unusual price behavior, and effects of unusual events on price are discussed. Production and price tables are cited. ***Orris C. Herfindahl.*** 260 pp. 1959. John Hopkins Press, Baltimore. (HD9539.C5 H42c)

9169 Europe's Coal and Steel Community. An Experiment in Economic Union. Background and objectives of the community, production and markets, steel: costs of production and investments, coal: costs of production and investments, concentrations, steel: concerted practices, prices and competition, coal: concerted practices, price regulation, the energy market, external commercial policy and trade, transport rate problems, social policies, the road ahead are discussed. ***Louis Lister.*** 495 pp. 1960. Twentieth Century Fund, New York. (HD9525.A2 L69e)

9170* Is There Going to Be Wax-Shortage? Rising Consumption of Waxes in the Packing Industry. Gives a survey of the wax industry in the USA with a special reference to the consumption of waxes in the packing industry. Discusses the types of waxes and their application during the last few years. Predicts that the consumption of waxes is going to rise still more sharply in the coming years and suggests ways and means to meet this expected shortage in the future. (*In German.*) Wird ein Mangel an Wachsen eintreten? Steigender Verbrauch von Wachsen in der Verpackungs-Industrie. ***W. Schweisheimer.*** *Fette, Seifen, Anstrichmittel*, v. 62, no. 3, Mar. 1960, p. 182 + 3 pages.

9171* Inventory Policies and Related Numerical Approximations. The average stock level is estimated to be the arithmetic mean of the expected high and low levels. However, if run-out fraction is large, this is inaccurate. ***Charles E. Clark and Alan J. Rowe.*** *Journal of Industrial Engineering*, v. 11, no. 1, Jan.-Feb. 1960, p. 8-17.

9172 The Stages of Economic Growth, a Non-Communist Manifesto. The five stages of growth—a summary; the preconditions for take-off; the take-off; the drive to maturity; the age of high mass-consumption; Russian and American growth; the relative stages of growth and aggression, and the problem of peace are discussed. ***W. W. Rostow.*** 179 pp. 1960. Cambridge University Press, New York. (HB199 R73s)

9173 Statistical Forecasting for Inventory Control. Averages and trends, noise, safety factors, cyclic patterns, order points are discussed. ***Robert G. Brown.*** 232 pp. 1959. McGraw-Hill, New York. (HF5681.S8 B81s)

See also: **9233** (survey of Canadian U and Th industry); **9257** (economics of El Salvador mine).

FLUID MECHANICS

9174 Experiments on the Departure From Chemical Equilibrium in a Supersonic Flow. Stationary supersonic nozzle flow of a reacting gas mixture, in thermodynamic equilibrium or in states between equilibrium and frozen flow, was investigated experimentally and analytically. With this fully determined flow system, it was possible to check various criteria to predict departures from equilibrium. ***Peter P. Wegener.*** *ARS Journal*, v. 30, Apr. 1960, p. 322-329.

9175 Magnetohydrodynamic Effects Upon Heat Transfer for Laminar Flow Across a Flat Plate. Forced-convection heat transfer for laminar flow of electrically conducting fluids across a flat plate is considered for a magnetic field of constant inductance acting normal to the free stream velocity and fixed relative to the plate. ***R. D. Cess.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 82, no. 2, May 1960, p. 87-93.

9176 A Viscometer for Mineral Suspensions. The measurement of the viscosity of mineral slurries, using a modified falling-ball viscometer, is described. In the system used, a plummet was pulled vertically through the slurry under test at a rate governed by an external weight. The velocity of the plummet was established by means of two Geiger tubes outside the viscometer tube. ***G. R. Purdy and G. G. Eichholz.*** *Canada, Mines Branch, Technical Bulletin TB* 11, Dec. 10, 1959, 37 pp. (TN26 C16.5tb Contin.)

9177 The Hydrodynamic Effect Between Approaching Surfaces With Interposed Viscous Fluid Films, and Its Influence on Surface Deformations. Implications in the case of flat and parallel approaching faces are discussed at some length, since they demonstrate clearly the marked influence of the pressure—viscosity dependence. ***L. H. Butler.*** *Institute of Petroleum, Journal*, v. 46, Mar. 1960, p. 63-73.

9178* Flow Measurement by the Salt-Dilution Method. The salt-dilution method, in which a chemical salt is injected into the main stream at a known rate, and samples are taken downstream has been studied in 1,6, and 20 in. pipelines in the laboratory, and in a 40 in. pipe at Kinlochleven. Volumetric as well as colorimetric methods of analysis were used to measure the concentrations of sodium dichromate, the salt adopted for these tests. ***E. A. Spencer, J. S. Tudhope, and J. I. N. Morris.*** *Institution of Water Engineers, Journal*, v. 14, no. 3, May 1960, p. 215-235 + 2 plates.

9179* Heat Transfer of Rarified Gas Flowing Around a Wall. The Blazius-Rubezin method is generalized for the case of supersonic flow of a body in a rarified gas in the presence of slippage. (*In Russian.*) Teploobmen obtekaniem razrezhennogo gaza so stenkoĭ. ***A. A. Pomerantsev.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 3, no. 5, May 1960, p. 3-11.

9180* Significant Structures in Liquids. V. Thermodynamic and Transport Properties of Molten Metals. Discusses application of the method of significant structures in predicting viscosities and self-diffusion coefficients of molten metals at various temperatures and pressures. ***Charles M. Carlson, Henry Eyring, and Taikyue Ree.*** *National Academy of Science, Proceedings*, v. 46, May 1960, p. 649-659.

9181* The Dolphins' Secret. Microscopic studies showed that the outer skin of dolphins acts as a damper of turbulence energy—hence their high swimming speed. The skin structure has been simulated in a coating for tank models which may prove adaptable to aircraft as well as underwater vessels. ***Max O. Kramer.*** *New Scientist*, v. 7, May 5, 1960, p. 1118-1120.

9182 A Cell-Cluster Theory for the Liquid State VI. Binary Liquid Solutions and Hole Theory. The formal cell-cluster theory is given. The configurational partition function is expanded in terms of cluster integrals which are small if the molecules are mainly confined to the lattice sites of a virtual lattice system. The evaluation of the partition function is performed in the quasi-chemical and in the Bragg-Williams approximation. The methods used are very similar to those employed by Guggenheim. When only single cells are taken into account, a generalization of the partition function used by Prigogine is obtained. The corrections due to the introduction of clusters of two cells are applied in some cases. The same

formalism can be used to construct the cell-cluster theory for a liquid with a fixed number of holes. Modifications for the case of clusters of one and two cells are given. ***John S. Dahler and E. G. D. Cohen.*** *Physica*, v. 26, Feb. 1960, p. 81-102.

9183 The Measurement of Flow Anisotropy in Pure Liquids. A new experimental technique to enable a weak birefringence to be measured was developed, the liquid being sheared for the shortest possible time (about 10 sec), so that the heating effects within the liquid were negligibly small. Measurements on ethyl cinnamate, $CHCl_3$, and CCl_4 are described. ***J. V. Champion.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 421-433.

9184 Flow and Stress Near an Interface Between Stratified Liquids. Observations are made of a density current system in which salt water flows turbulently under a pool of fresh water. The density and rate of flow of the salt water are varied, resulting in varying degrees of agitation of the interface. Measurements include the interface slope, the velocity and density profiles, and the rate of mixing. ***Karl Lofquist.*** *Physics of Fluids*, v. 3, no. 2, Mar.-Apr. 1960, p. 158-175.

9185 Exact Solutions for the One-Dimensional Viscous Flow of a Perfect Gas. Velocity-free equations are derived for the unsteady one-dimensional real fluid flow of a perfect gas. These equations admit a pressure-time symmetry, a stress symmetry, and a displacement symmetry. Fundamental solutions associated with each of the three symmetries are reported. ***Gerald Rosen.*** *Physics of Fluids*, v. 3, no. 2, Mar.-Apr. 1960, p. 191-196.

9186* The Use of Radioactive Isotopes in the Measurement and Control of Flow Velocities in Closed Conduits. The measurement is based on the modulation of the intensity of a beam of γ-rays by means of rotating Pb diaphragms. A scintillation counter was used as a ray detector. An electronic control transformed the modulated entrance impulses into one continuous voltage proportional to the number of rotations of the Pb diaphragms. The method can be expected to be in error by less than 1%. (*In German.*) Über die Messung und Regelung von Strömungsgeschwindigkeiten in geschlossenen Rohrleitungen mit Hilfe radioaktiver Isotope. ***W. Lange and S. Menzel.*** *Technik*, v. 15, Apr. 1960, p. 277-281.

9187 Methods of Differencing in Eulerian Hydrodynamics. Differencing in one dimension and in two dimensions are cited and discussed. Various illustrations are cited. ***H. Jerry Longley.*** *U. S. Atomic Energy Commission, LAMS*-2379, Feb. 1959 (Issued Apr. 11, 1960), 83 pp. (UF767 Un3.1La Contin.)

9188 Heat Transfer, Burnout, and Pressure Drop for Water in Swirl Flow Through Tubes With Internal Twisted Tapes. Experimental determinations of heat-transfer coefficients, burnout heat fluxes, and friction factors have been made for swirl flow of low- and moderate-pressure water through electrically heated Al, Ni, and Cu tubes containing full-length Inconel twisted tapes. ***W. R. Gambill, R. D. Bundy, and R. W. Wansbrough.*** *U. S. Atomic Energy Commission, ORNL*-2911, Apr. 11, 1960, 105 pp. (UF767 U3o Contin.)

9189 Longitudinal Dispersion in Two-Phase Continuous—Flow Operations: Solution and Tables for Cocurrent Flow. The mathematical derivation of solutions for longitudinal dispersion in chemical-process equipment, carried out previously by Miyauchi for countercurrent flow, is extended here to the case of cocurrent flow. These results are particularly applicable to certain types of heat exchangers, flash evaporators, and line-mixing solvent extractors. ***Terukatsu Miyauchi, Alice K. McMullen, and Theodore Vermeulen.*** *U. S. Atomic Energy Commission, UCRL*-9112, Mar. 14, 1960, 24 pp. (UF767 U3u Contin.)

See also: **8752** (falling liquid sheets—mass transfer).

FOOD TECHNOLOGY

9190* Effect of a Dietary Lysine Deficiency on the Concentration of Amino Acids in the Deproteinized Blood Plasma of Chicks. ***Jean A. Gray, Ellen M. Olsen, D. C. Hill, and H. D. Branion.*** *Canadian Journal of Biochemistry and Physiology*, v. 38, May 1960, p. 435-441.

9191* Studies on the Nutritional Value of Defatted Fish Flour. Defatted fish flour is an excellent source of high quality protein, and should be of particular value in supplementing diets deficient in lysine. ***A. B. Morrison and J. A. Campbell.*** *Canadian Journal of Biochemistry and Physiology*, v. 38, May 1960, p. 467-473.

9192* The Compatibility of Dehydrated Army Rations With Chlorinated and Iodine-Treated Surface-Waters. ***Morris R. Rogers, Arthur M. Kaplan, and Elizabeth Pillion.*** *Food Technology*, v. 14, May 1960, p. 240-245.

9193* Combined Irradiation—Heat Processing of Canned Foods: Green Peas Inoculated With Anaerobic Bacterial Spores. Combined irradiation–heat processing is shown to be synergistic for killing anaerobic bacterial spores inoculated into canned green peas. The lowered schedules possible with combined processing may prove to be of value for preserving vegetables as well as meats. ***Lloyd L. Kempe, John T. Graikoski, and Peter F. Bonventre.*** *Journal of Biochemical and Microbiological Technology and Engineering*, v. 2, no. 1, Apr. 1960, p. 1-8.

9194* Serum Cholesterol Concentrations of Various Ethnic Groups in Hawaii. Increase of serum cholesterol with age is not obligatory but is attributable to environmental hypercholesterolemic influences. Race is of negligible influence in determining serum cholesterol concentrations, whereas undetermined environmental factors are of great influence. ***Lucile F. Adamson.*** *Journal of Nutrition*, v. 71, no. 1, May 1960, p. 27-36.

9195* Effects of Diet on Fish Oil Toxicity in the Rat. Immature rats fed a purified low-fat diet supplemented with 10% of fish oil (i.e., crude or refined tuna oil, crude sardine oil, menhaden oil or cod liver oil) showed a highly significant retardation in growth accompanied by diarrhea. These effects were largely counteracted by the concurrent administration of cottonseed oil at a 10% level in the diet. Soybean oil, sesame oil, corn oil and wheat germ oil at a 10% level of feeding were also active in this regard but olive oil, coconut oil, hydrogenated cottonseed oil, butter fat and lard when fed at a 10% level in the diet had little if any protective effect. ***Benjamin H. Ershoff.*** *Journal of Nutrition*, v. 71, no. 1, May 1960, p. 45-53.

9196* The Response of Man to Dietary Cholesterol. Between intakes of 13 and 634 mg of cholesterol per day, the serum cholesterol increased sharply but no further significant increases were obtained at daily intakes of 1300 to 4500 mg. ***J. M. R. Beveridge, W. F. Connell, G. A. Mayer, and H. L. Haust.*** *Journal of Nutrition*, v. 71, no. 1, May 1960, p. 61-65.

9197* Studies on the Roasting of Coffee. Characteristics of arabica and robusta coffee were investigated with special reference to the relation between finishing temperature of roast, color, swelling and breaking strength of beans and the chemical composition of the brew. The roasting characteristics of the two varieties have been found to be different, and color development has been found to be proportional to finishing temperature and duration of roasting. A linear relation was observed between the color of roast coffee and swelling ratio of the beans; the latter is influenced more by the temperature at which roasting is done than by the duration of roasting. During roasting, the total solids content and color of the brew from roasts increase with roasting up to a point beyond which they decrease; chlorogenic acid and total sugar also decrease during roasting but caffeine content remains almost constant. It was observed that the degree to which coffee beans are roasted can be defined in terms of finishing temperature, color, breaking strength and swelling ratio of the roast beans. ***C. P. Natarajan, et al.*** *Journal of Scientific & Industrial Research*, v. 19A, Jan. 1960, p. 32-37.

9198 Treatment of Meats With Ionising Radiations. III. Radiation Pasteurisation of Whole Eviscerated Chicken Carcasses. When the meat was stored at 1 C, a dose of 0.8 Mrad gave a five-fold extension of the time required for putrefactive spoilage, and the flavor changes after such a dose were usually not noticed in roasted chickens. The quality of the irradiated carcasses tended to deteriorate during storage, however, and this loss of quality was apparent when the chickens

were stored for more than about one and a half times the period required for spoilage of untreated carcasses stored at 1 C. ***B. Coleby, M. Ingram, and H. J. Shepherd.*** *Journal of the Science of Food and Agriculture*, v. 2, Feb. 1960, p. 61-71.

9199 Interaction of Starch With Sucrose Stearates and Other Antistaling Agents. The reaction of sucrose monostearate (SMS) with starches and starch fractions is similar to that of various substances with "antistaling" activity with starch. SMS forms an insoluble complex with starches and competitively inhibits the reaction of iodine with amylose. Wheat starch granules adsorb SMS and it is suggested that the formation of an insoluble complex on the surface of the granules may play a part in the "antistaling" activity of SMS. ***E. J. Bourne, A. I. Tiffin, and H. Weigel.*** *Journal of the Science of Food and Agriculture*, v. 2, Feb. 1960, p. 101-109.

9200 Comparison of the Amino-Acid Composition of the Protein in Flour and Endosperm From Different Types of Wheat, With Particular Reference to Variation in Lysine Content. ***E. E. McDermott and J. Pace.*** *Journal of the Science of Food and Agriculture*, v. 2, Feb. 1960, p. 109-115.

9201* The Utilisation of Apples. ***V. L. S. Charley.*** *Journal of the Science of Food and Agriculture*, v. 11, Apr. 1960, p. 177-180.

9202* The Utilisation of Citrus Fruit. ***E. H. G. Smith and D. E. Kay.*** *Journal of the Science of Food and Agriculture*, v. 11, Apr. 1960, p. 181-188.

FUELS AND COMBUSTION

9203 Fluorescent Technique for Determining the Cross-Sectional Drop Size Distributions of Liquid Sprays. The development of a unique laboratory instrument which measures cross-sectional drop sizes in dynamic liquid sprays by a fluorescent technique is described. Consists of focusing a short duration, high intensity radiation flash into a thin sheet of radiation which intersects the spray nearly perpendicularly to the spray axis. ***G. M. Benson, M. M. El-Wakil, P. S. Myers, and O. A. Uyehara.*** *ARS Journal*, v. 30, May 1960, p. 447-454.

9204 Polymerization of Solid Propellants. The solution was achieved numerically on an electronic digital computer using explicit finite difference methods. The nature of the polymer fraction distribution is discussed in this note. ***W. H. Groetzinger, III.*** *ARS Journal*, v. 30, May 1960, p. 498-499.

9205* The Mechanism of the Predetonation Propagation of Flame in Rough Tubes. A study of the heating mechanism and of the structure of accelerating flames in the predetonation period. Considers the case of rough tubes in which there is a mechanism of propagation of the detonation with adiabatic inflammation of the gas from compression in the detonation wave. (*In Russian.*) Mekhanizm predetonatsionnogo rasprostraneniia plameni v sherokhovatykh trubakh. ***V. S. Babkin and L. S. Kozachenko.*** *Akademiia Nauk SSSR, Doklady*, v. 131, no. 3, Mar. 1960, p. 591-592.

9206 Decanter Sludge Recovery Process at Sparrows Point. Tar decanter sludge and other tar sludges can be milled with the production of a fluid tar-like material which can be utilized as fuel. The material has a high free-C content which is an advantage in the open hearth. ***H. B. Scharf.*** *Blast Furnace and Steel Plant*, v. 48, May 1960, p. 439-442.

9207 High Temperature Testing of Coke and Synthetic Agglomerates. The modified high-temperature compression test for coke substantiates the original findings in that relative performance characteristics can be predicted with a substantial degree of reliability, i.e., blast furnace productivity decreases with decreasing coke high-temperature compression strength. ***P. J. Zorena, M. O. Holowaty, and C. M. Squarcy.*** *Blast Furnace and Steel Plant*, v. 48, May 1960, p. 443-451.

9208* Remarks in Connection With the Investigation of Pyrolysis of Mineral Coal by Differential Thermal Analysis. The curves of differential thermal analysis of expanded fat coal exhibit a sharp increase between 420 and 450 C, interpreted as an exothermic effect. Reasons are given why this increase is due to a sudden increase in the heat conductivity of the coal and at the very moment when the grains melt. (*In German.*) Bemerkungen zur Untersuchung der Pyrolyse von Steinkohlen mit Hilfe der Differentialthermoanalyse. ***A. F. Boyer and P. Payen.*** *Brennstoff-Chemie*, v. 41, no. 4, Apr. 1960, p. 104-106.

9209* Active Semicokes, Their Preparation and Suitability for the Adsorption of Hydrocarbons and High Coal Gas Purification. II. Laboratory Tests: Temperature-Time Tests. The effects of the most important factors during thermal activation of the a-semicokes, temperature and duration of the process on the absorption power, bulk weight, output and ash content of the products formed are described. The composition of the water gas resulting from activation and the size of the internal surface are examined. An a-semicoke under service conditions is tested for its adaptability to town gas purification. (*In German.*) Aktivgrude—ihre Herstellung und Eignung für die Adsorption von Kohlenwasserstoffen und die Feinreinigung von Steinkohlengas. Laboratoriumsversuche: II. Temperatur-Zeit-Versuche. ***Werner H. Spichal.*** *Brennstoff-Chemie*, v. 41, no. 4, Apr. 1960, p. 113-119.

9210 Briquetting Coal With Binders and Statistical Evaluation of Briquet Tests. Summarizes the most important recent developments in coal briquetting with binders, in order to help in the planning of specific research programs under local conditions of individual briquetting plants. ***R. P. Charbonnier and J. Visman.*** *Canada, Mines Branch, Technical Bulletin TB* 9, Oct. 1959, 34 pp. (TN26 C16.5tb Contin.)

9211 Consider Hybrid Propulsion Systems. Combining a solid-fuel grain with a liquid oxidizer gives a hybrid rocket having reduced system complexity and increased reliability. ***F. J. Hendel and E. H. Cavecche.*** *Chemical Engineering*, v. 67, May 30, 1960, p. 93-96.

9212* Gasification of Coal Fines by Fluidization. A gasification process of coal fines is devised to give high yields. The quality of the gas produced depends chiefly on the temperature of gasification (950 to 1,350 C) and on the thickness of the fluidized layer. (*In French.*) La gazéification des fines de charbon par fluidisation. ***J. Jequier, L. Longchambon, and G. Van de Putte.*** *Chimie & Industrie*, v. 83, no. 4, Apr. 1960, p. 541-548.

9213 The Origin of the Blue Continuum in the Hydrogen Flame. The results of application of flame-photometric techniques developed by Sugden and co-workers for the quantitative measurement of concentrations of H atoms and OH radicals in flame gases strongly suggest the origin of the H-flame continuum to lie in the radiative association $H + OH \rightarrow H_2O + h\nu$. ***P. J. Padley.*** *Faraday Society, Transactions*, v. 56, Apr. 1960, p. 449-454.

9214* The Role of Size and Quality of Coke for Use in Cupola Furnaces. Found that the mechanical resistance of coke to shock is an important factor. The desired size of coke is 80 mm. or more. A dense coke is preferred. (*In French.*) Role du calibre et de la qualité du coke dans le fonctionnement du cubilot. ***Roger Loison, Louis Soubrier, and Maurice Decrop.*** *Fonderie*, no. 171, Apr. 1960, p. 121-134.

9215 Rocketdyne Solid Operation Grows. To get higher energies, Rocketdyne is conducting research on a broad spectrum. Typical areas of interest are the nitro compounds and borohydrides and the encapsulation of such highly reactive ingredients as $LiAlH_4$. ***Jay Holmes.*** *Missiles and Rockets*, v. 6, no. 20, May 16, 1960, p. 24 + 2 pages.

9216 Rocket Fuel Development Accelerates. A preview of developments, both solid and liquid. ***Jay Holmes.*** *Missiles and Rockets*, v. 6, no. 22, May 30, 1960, p. 74-77.

9217 Propagation of Flames Supported by a Zeroeth-Order Chemical Reaction. Flames supported by zeroeth-order chemical reactions have two very useful unique properties. Their characteristics are independent of diffusion, and the chemical reactions are completed at a finite point in space. These properties should make zeroeth-order flames ideally suited to serve as "global" reactions for complicated flame systems. ***Joseph O. Hirschfelder and Sarah S. Van Domelen.*** *Physics of Fluids*, v. 3, no. 2, Mar.-Apr. 1960, p. 210-216.

9218* Investigation of the Thermal Decomposition of Propane-Butane Mixtures. Examination of the degree of reproducibility of the results of pyrolysis of propane-butane mixtures in laboratory tubular reactors (temperature 600-800 C), where the increase of reproducibility with the rise of temperature has been established. As a result of the study of the influence of temperature (650-800 C) and contact time (0.6-127.5 sec) on the course of the ethylene-propylene pyrolysis of propane-butane mixtures, several regularities were observed. (*In Polish.*) Badania nad rozkładem termicznym mieszanin propanowobutanowych. ***Tadeusz Mazoński and Marian Taniewski.*** *Przemysł Chemiszny,* v. 39, no. 3, Mar. 1960, p. 170-175.

9219* On Classification and Nomenclature of Coal Microcomponents Needed for Technical Purposes. Discusses a new classification of coal microcomponents observed under the microscope in reflected light, based on the original matter, its botanic nature, the degree of gelling, and on the degree of its primary oxidation. According to the degree of gelling, the writer distinguishes non-gelled, partly gelled, and gelled substances from the point of view of their botanic nature—wood-like, parenchima and córtéx tissues (also lipoids and algae)— and according to the degree of primary oxidation. (*In Russian.*) O klassifikatsii i nomenklature mikrokomponentov kamennykh uglei dlia tekhnologicheskikh tselei. ***A. B. Travin.*** *Sovetskaia Geologiia,* v. 3, no. 4, Apr. 1960, p. 57-65.

9220 Grinding Properties of Coal. The coeffiicent of grindability reflects the physical properties of the fuel. Development of a new method eliminating weak points of existing testing procedures is recommended. Some improvements of the existing methods are suggested. (*In Czech.*) O metitelnosti. ***M. Proks.*** *Strojírenství,* v. 10, no. 4, Apr. 1960, p. 277-280.

9221 Synthetic Liquid Fuels From Hydrogenation of Carbon Monoxide. Cobalt and Iron Catalysts for the Fischer-Tropsch Synthesis. Preparation and Characterization of Catalysts, Synthesis Tests, and Reaction Mechanism. II. Noted are the unusual X-ray diffraction patterns obtained with precipitated, reduced-cobalt catalysts. These patterns indicate that the metal has a disordered layer structure that represents a hybrid between the face-centered cubic and the hexagonal close-packed modifications of Co. In contrast to cobalt and nickel carbides, carbides of iron, as well as iron nitrides and carbonitrides, are active in the synthesis. ***J. F. Shultz, et al.*** *U. S. Bureau of Mines, Bulletin* 578, 1959, 139 pp. (TN21 Un3b Vis.)

9222 Effects of Temperature Variations on Contact Angles for Coal and Related Substances. Equipment, samples and reagents used for contact-angle determinations, preparation of samples and procedure for contact-angle determinations and determinations of interfacial tensions are discussed. ***J. B. Gayle and A. G. Smelley.*** *U. S. Bureau of Mines Report of Investigations* 5585, 1960, 16 pp. (TN21 Un3r Vis.)

9223 The Fischer-Tropsch Synthesis in the Oil-Circulation Process: Experiments With a Nitrided Fused-Iron Catalyst. Pertains to coal. ***D. Bienstock, et al.*** *U. S. Bureau of Mines Report of Investigations* 5603, 1960, 32 pp. (TN21 Un3r Vis.)

9224 Simulated Underground Gasification of Coal and Electrolinking-Carbonization. Method of Preparing Path in a Coalbed. Observed that O in the combustion air reacted with the first hot C contacted, resulting in maximum coal utilization at air-inlet ports. Also revealed that when the combustion path became too large the quality of the product gas deteriorated, owing to loss of contact of the reactants. ***Marvin W. Wilson, et al.*** *U. S. Bureau of Mines Report of Investigations* 5605, 1960, 61 pp. (TN21 Un3r Vis.)

9225 Effect of Transverse Acoustic Oscillations on the Vaporization of a Liquid-Fuel Droplet. A theoretical analysis of the effect of a standing transverse acoustic field on the vaporization of a liquid *n*-octane droplet was made. Three differential equations expressing the drop axial and transverse acceleration and vaporization rate were solved on an analog computer for a range of gas conditions, drop diameters from 10 to 500 microns, axial gas velocities from 0 to 800 ft/sec, and root-mean-square transverse particle velocities from 0 to 400 ft/sec at frequencies of 200, 1000, and 4000 cps. ***Paul R. Wieber and William R. Mickelsen.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-*D-287, May 1960, 25 pp. (TL570 Un3t Vis.)

9226 Temperature and Composition of a Plasma Obtained by Seeding a Cyanogen-Oxygen Flame With Cesium. The temperature and composition of a cyanogen-oxygen flame seeded with Cs are calculated approximately by assuming that the combustion is adiabatic and that the product mixture is in thermodynamic equilibrium. For initial mole fractions of Cs up to 0.1 and flame pressures from 0.01 to 1 atmosphere, electron concentrations up to 4.4×10^{16} per cc. and plasma temperatures in the range of 4000 to 5000 K are obtained. ***Richard A. Hord and J. Byron Pennington.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-*D-380, May 1960, 18 pp. (TL570 Un3t Vis.)

See also: **9248** (reverse combustion oil recovery); **9324** (propellant vaporization in rocket engines); **9408** (coke technology).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

9227 Some Results of the Determination of the Structural Parameters of the Atmosphere Using the Third Soviet Artificial Earth Satellite. Recently, experiments have been carried out on the determination of the density of the atmosphere at great altitudes. A particularly large contribution to the study resulted from the investigations made with Soviet artificial Earth satellites, which made it possible to determine the density of the atmosphere both from measurements with manometers installed on the third Soviet Earth satellite and from the drag on the satellites. ***V. V. Mikhnevich, B. S. Denilin, A. I. Repnev, and V. A. Sokolov.*** *ARS Journal,* v. 30, Apr. 1960, p. 407-413.

9228 An Experimental Study of Drill-String Vibration. Equipment was developed for the measurement of axial force, torque, and axial and rotational motions at the top of a drill string. Measurements made in two wells with this equipment represent the first time these quantities were recorded during drilling. ***I. Finnie and J. J. Bailey.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 82, no. 2, May 1960, p. 129-135.

9229* On the Relation Between Structure and Chemical Composition in Iron Meteorites. Attempts to find basic relationships between the composition, especially the Ni content, and also the Ga and Ge contents, and the structure studied, for further investigations of this process. (*In Russian.*) K voprosu o zavisimosti struktury zheleznykh meteoritov ot khimicheskogo sostava. ***A. A. Iavnel'.*** *Akademiia Nauk SSSR, Doklady,* v. 131, no. 5, Apr. 11, 1960, p. 1049-1052.

9230* Special Quantitative Indication of Deep Water Life in the Oceans. A study of the approximative quantity of types of abyssal fauna in various latitudes and depths with examples of the distribution of deep water fauna, of the quantitative distribution of benthos in the northern part of the Pacific Ocean, and of the variations in the amplitude of oscillations of the biomass of benthos and plankton with the depth. (*In Russian.*) Spetsial'naia kolichestvennaia kharakteristika glubokovodnoĭ zhizni v okeane. ***L. A. Zenkevich.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Geograficheskaia,* 1960, no. 2, Mar.-Apr., p. 10-16.

9231 Adaptation of the Radiosonde for Direct Measurement of Radio Refractive Index. A technique for converting a radiosonde for direct measurement of radio refractive index of the air using standard meteorological sensors. ***A. H. Clinger and A. W. Straiton.*** *American Meteorological Society, Bulletin,* v. 41, May 1960, p. 250-252.

9232* The Curvature of the Path of Some Meteors During Their Motion Through the Earth's Atmosphere. Photography revealed that there is a change of direction in the motion of the meteor, not caused by its falling. The heterogeneity of the meteor at a given height caused a change in its shape which led to the observed path curvature. (*In Russian.*) Ob iskrivlenii

puti nekotorykh meteorov pri ikh dvizhenii v zemnoĭ atmosfere. ***M. D. Popova.*** *Astronomishcheskii Zhurnal,* v. 37, no. 2, Mar.-Apr. 1960, p. 352-353.

9233 A Survey of the Uranium Industry in Canada. Uranium producers in Ontario, Saskatchewan and of the Northwest Territories are cited. Mining methods, ore treatment processes, production costs, refining, prices, markets, uses and requirements, world resources of U, and Th, are described. ***J. W. Griffith.*** *Canada Mines Branch, Mineral Information Bulletin MR* 34, Nov. 1959, 94 pp. (TN26 C16.55m Contin.)

9234* High-Altitude Cosmic Ray Measurements at Fort Churchill. Measurements with rocket-borne Geiger counters were carried out at altitudes up to 250 km at Fort Churchill, Manitoba. The total primary cosmic ray intensity at a time near a solar maximum was determined and compared with other measurements. ***I. B. McDiarmid and D. C. Rose.*** *Canadian Journal of Physics,* v. 38, May 1960, p. 638-641.

9235* The Origins of the Massive Sulphides. II. Pyrite in massive form is a monomineralic igneous rock. Massive pyrite bodies have crystallized from liquid "matte" contaminated solely with hydrous and/or siliceous elements. In specific instances, vein sulfides have crystallized from pockets of liquid matte. ***W. James Bichan.*** *Canadian Mining Journal,* v. 81, May 1960, p. 69-72.

9236 Contemporary Geodesy. Proceedings of a Conference Held at the Harvard College Observatory—Smithsonian Astrophysical Observatory, Cambridge, Massachusetts, December 1-2, 1958. Geodetic fundamentals, problems of modern geodesy, and geodesy and space are discussed. ***Charles A. Whitten and Kenneth H. Drummond, editors.*** 96 pp. 1959. American Geophysical Union of the National Academy of Sciences National Research Council. (QB275 C76c)

9237 The Application of Radioactive Isotopes to the Study of Motion of Silt and Pebbles in the Rivers and in the Sea. Reviews techniques of labeling, immersing and detecting silts, sands, and pebbles. The effect of burying the active material is emphasized. Describes different experiments which have been carried out to date. (*In French.*) Application des isotopes radioactifs à l'étude des mouvements des sédiments et des galets dans les cours d'eau et en mer. ***R. Hours and P. Jaffry.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1269, 1959, 30 pp. (QC770 F84.2r Contin.)

9238 Beach Sediments Drift Study by Means of Radioactive Tracers. The present state of sediment drift studies by means of radioactive tracers is revealed. Various processes of labeling, immersion and detection, used in France and other countries, are reviewed. Refers to a more extended analysis of some aspects of the problem. (*In French.*) L'etude du transport littoral par la méthode des traceurs radioactifs. ***Pierre Jaffry and Richard Hours.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1271, 1959, 21 pp. + 11 plates. (QC770 F84.2r Contin.)

9239* Alkali Metals in Stone Meteorites. The measurements reported were made by the method of stable isotope dilution. Tracer solutions of K^{41}, Rb^{87}, and Cs^{137} were calibrated against standard solutions of these elements. ***P. W. Gast.*** *Geochimica et Cosmochimica Acta,* v. 19, no. 1, Mar. 1960, p. 1-4.

9240* Ablation Deposits on Iron Meteorites. Of eight irons examined, four showed both visible structural alterations and hardness gradients near the meteorite surface, each definitely associated with the effects of aerodynamic heating, and displayed at certain places on the surface a metallic deposit which differed markedly from its substrate. None of the remaining four irons showed any evidence of either aerodynamic heating, or of an ablation deposit. ***R. E. Maringer.*** *Geochimica et Cosmochimica Acta,* v. 19, no. 1, Mar. 1960, p. 5-6.

9241* The Record in the Meteorites. II. On the Presence of Aluminium-26 in Meteorites and Tektites. A search for cosmic-ray produced Al^{26} was undertaken in meteorites and tektites, using γ-γ coincidence spectrometry. The sensitivity and specificity of this method were sufficient to permit non-destructive measurement of Al^{26} in a 70g specimen of the Plainview chondrite. ***E. Anders.*** *Geochimica et Cosmochimica Acta,* v. 19, no. 1, Mar. 1960, p. 53-62.

9242 Stabilization of Soils. Effect of petrographic variations of southwestern Iowa loess on stabilization with Portland cement, stabilization of bank-run gravel by $CaCl_2$, strength of soil-cement as a function of degree of mixing are discussed. ***R. L. Handy, D. T. Davidson, and T. Y. Chu.*** *Highway Research Board, Bulletin* 98, 1955, 52 pp. (TE1 H53b Contin.)

9243 South African Shale-Oil Bitumen as a Road Binder. Road experiments show that this bitumen is less durable than certain petroleum bitumens and fluxed lake asphalt from Trinidad. ***E. J. Dickinson.*** *Institute of Petroleum, Journal,* v. 46, Mar. 1960, p. 74-83.

9244* A Semi-Empirical Theory of Vertical Turbulent Diffusion in the Boundary Layer of the Atmosphere. The nonstationary problem is considered of the vertical turbulent diffusion of homogeneous aerosol from an instantaneous point source in the boundary layer of the atmosphere. The equation of the semiempirical theory of turbulent diffusion is solved for initial conditions and boundary conditions, assuming that the coefficient of vertical turbulent diffusion changes with height correctly. (*In Russian.*) O poluempiricheskoĭ teorii vertikal'noĭ turbulentnoĭ diffuzii v pogranichnom sloe atmosfery. ***I. L. Karol'.*** *Inzhenerno-Fizicheskiĭ Zhurnal,* v. 3, no. 4, Apr. 1960, p. 54-64.

9245* Dependence of the Speed of Drilling With Pneumatic Rock Drills and of the Air Consumption on the Pressure of the Compressed Air. With an increase in air pressure, for instance from five to six atm., the drilling speed increases considerably during the boring of softer rocks. The general and specific consumption of air varies in direct proportions to the pressure in the air. (*In Russian.*) Zavisimost' skorosti bureniia pnevmoudarmikami i raskhoda vozdukha ot davleniia szhatogo vozdukha. ***N. U. Turuta, V. D. Legeza, and L. V. Filatov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Gornyĭ Zhurnal,* 1959, no. 11, p. 51-53.

9246* Investigation of the Displacement of Rocks in the Exploitation of Constantly Frozen Placers. According to the character and intensity of deformation, the structure and lithological composition of the rocks of the leaning strata, the roof can be divided into firm, average firm, unstable, loose and bending roofing. The size of the stable arch of the roof depends basically on the type of roof, the depth of exploitation, the length of the wall and, in the case of a 50 m long wall, varies from 300-400 to 2000 m^2 and more. (*In Russian.*) Issledovanie sdvizheniia gornykh porod v usloviiakh razrabotki vechnomerzlykh rossypeĭ. ***V. V. Kioresko.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Gornyĭ Zhurnal,* 1959, no. 12, p. 3-14.

9247* Observed Magnetic Effects From Meteors. A striking feature of the activity levels thus far available is the occurrence of occasional large increases in the frequency band centered at 1.5 cps. ***Alvin W. Jenkins, Jr., Charles A. Phillips, Jr., and Elwood Maple.*** *Journal of Geophysical Research,* v. 65, no. 5, May 1960, p. 1617-1619.

9248* Reverse Combustion—A New Oil Recovery Technique. Comparative economics, explanation of reverse combustion, ahead of combustion zone, flame-front zone, future research are discussed. ***Robert H. Perry, Don W. Green, and John M. Campbell.*** *Journal of Petroleum Technology,* v. 12, May 1960, p. 11-12.

9249* Experimental Aspects of Reverse Combustion in Tar Sands. Successful application to tar sands will depend on the outcome of two practical considerations. First, the situation appears to be that, wherever a tar sand has adequate air permeability, the oil saturation is too low; where the oil saturation is high, gas permeability is inadequate. ***Ronald L. Reed, Denzel W. Reed, and Joseph H. Tracht.*** *Journal of Petroleum Technology,* v. 12, May 1960, p. 13-14.

9250* Development and Field Use of High-Frequency Gas-Operated Rotary-Percussion Drilling Tool. A successful air- or gas-operated percussion tool has been developed and used in drilling nine wells. Penetration rates with the percussion tool in these wells have averaged 2.5 times faster than those obtained with rotary gas drilling and approximately five times greater than rotary mud drilling. ***G. C. Howard, R. P. Vincent, and L. B. Wilder.*** *Journal of Petroleum Technology,* v. 12, May 1960, p. 20-26.

9251* Analysis of Waterflood Performance—Block VI Ranger Zone, Wilmington Field, Calif. The dual purpose to be accomplished in the flood is explained. The objectives are to effect an economic waterflood operation and to control subsidence of the overlying area through control of reservoir pressure. ***Gene E. Roark.*** *Journal of Petroleum Technology,* v. 12, May 1960, p. 45-51.

9252* New Developments in Induction and Sonic Logging. A new induction sonde with a radius of investigation about twice as large has been developed recently for the case of deep invasion. It has very nearly the same vertical resolution as the present sonde so that thin beds are defined as accurately as before. The characteristics of the new tool are described. ***M. P. Tixier, R. P. Alger, and D. R. Tanguy.*** *Journal of Petroleum Technology,* v. 12, May 1960, p. 79-87.

9253* Pyrolysite of Manganese, as a Catalyst of Paraffin Oxidation. When $KMnO_4$ accelerates paraffin oxidation early in the process, heterogeneous catalysis due to the mixture of higher manganese oxide and of potassium oxides occurs. The induction period for the acids is shortened due to the effects of the products of oxidation formed during the heating of paraffin with the accelerators in the presence of air. In proportion to the dissolution of the manganese oxides with formation of potassium manganese soaps dissolving in the product, a homogeneous catalytic phase appears, the fundamental role of which belongs to complex manganese-potassium compounds. (*In Russian.*) Piroliuzit margantsa, kak katalizator okisleniia parafina. ***B. N. Tiutiunnikov and A. A. Perchenko.*** *Khimiia i Tekhnologiia, Topliv i Masel,* v. 5, no. 4, Apr. 1960, p. 14-19.

9254* Testing Rock in Compression. When carrying out these tests, laboratory results can vary from a number of factors which indicate that the cause is a function of the rock structure and not of the test. Attempts to explain test results on a typical sandstone. ***C. L. Emery.*** *Mine & Quarry Engineering,* v. 26, May 1960, p. 196-202.

9255 Mineral Equilibria at Low Temperature and Pressure. Activity-concentration relations, carbonate equilibria, measurement of Eh and pH, partial pressure diagrams, Eh-pH diagrams, some goelogic applications of Eh-pH diagrams. ***Robert M. Garrels.*** 254 pp. 1960. Harper and Brothers, New York. (QE515 G19m)

9256* Radioisotopes in the Mineral Industry. Radioisotopes may be made available from a fixed source, a movable source, or as tracers placed in the material to be measured. The various uses to which the different sources are most readily applicable are shown. ***Fred L. Smith.*** *Mines Magazine,* v. 50, May 1960, p. 32-34.

9257 El Salvador, Its History and Development. The geology of the area, research on it, engineering control, development of El Salvador mine, plant construction and procurement of supplies, metallurgical operations, generalized flowsheet of materials handling from primary crusher to smelter, concentrator, Mo plant, concentrate handling, summary of metallurgical operations, dust control, heating and ventilation, power system, process water and hydroelectric plant, potable water supply, townsite, housing, transportation, and welfare are discussed in detail. *Mining Engineering,* v. 12, Apr. 1960, p. 340-382.

9258* Catalog Survey and Directory Number. A technological review of advances of the mineral industry, of metal and minerals, and of U. S. mining in 1959 is cited and a worldwide mining report is given. *Mining World,* v. 22, no. 5, Apr. 25, 1960, p. 3-296.

9259* Effects of Gas on the Performance of a Depth Pump. A link was found between the loss during pressure and the coefficient of admission. (*In Russian.*) Vliianie gaza na rabotu glubinnogo nasosa. ***N. N. Renin.*** *Neftianoe Khoziaĭstvo,* v. 28, no. 4, Apr. 1960, p. 25-28.

9260* On the Origin of the Solar System. Suggests that electromagnetic forces, of which earlier theories took no account, were instrumental in the formation of the planets. Also offers an explanation of Saturn's rings, and proposes that the Moon was a planet before the Earth was formed. ***Hannes Alfvén.*** *New Scientist,* v. 7, May 12, 1960, p. 1188-1191.

9261* Radio Astronomy and the New National Observatory. Establishment of the National Radio Astronomy Observatory at Green Bank in W. Va. and the decision to equip it with instruments of the most advanced type is noted. The Navy is building a 600-foot parabolic telescope at Sugar Grove, W. Va. ***Richard M. Emberson.*** *New York Academy of Sciences, Transactions,* v. 22, no. 6, Apr. 1960, p. 419-425.

9262* Meteorology: A Rediscovered Scientific Frontier. ***Thomas F. Malone.*** *New York Academy of Sciences, Transactions,* v. 22, no. 6, Apr. 1960, p. 458-461.

9263 Effect of Bit Weight on Drilling Rate. Points out that we still don't know much about the effect of bit weight on drilling rate. Discusses empirical approaches to the problem. ***Preston L. Moore and Carl Gatlin.*** *Oil and Gas Journal,* v. 58, no. 21, May 23, 1960, p. 90-93.

9264 Oil Property Evaluation. Elements of oil property evaluation, evaluation nomenclature, economic structure of the petroleum industry, factors influencing oil economics, the value of money, taxation of oil properties and income, calculation of reserves, prediction of future reservoir performance, decline curves, application of electric logs, radioactivity well logging and other problems are discussed. ***John M. Campbell.*** 523 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. (TN871 C150)

9265* Waterflood Curtailment—Pro and Con. An analysis. Effects of fluid injection should be examined in each individual case to determine whether curtailment of producing rates could cause detrimental results. ***Donald E. Menzie and Frank W. Cole.*** *Petroleum Engineer,* v. 32, May 1960, p. B-48 + 3 pages.

9266 Detection and Generation of Gravitational Waves. Methods are proposed for measurement of the Riemann tensor and detection of gravitational waves. These make use of the fact that relative motion of mass points, or strains in a crystal, can be produced by second derivatives of the gravitational fields. The strains in a crystal may result in electric polarization in consequence of the piezoelectric effect. Measurement of voltages then enables certain components of the Riemann tensor to be determined. Mathematical analysis of the limitations is given. Arrangements are presented for search for gravitational radiation. ***J. Weber.*** *Physical Review,* v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 306-313.

9267 The Physics of Clouds. The large-scale physics of clouds, the condensation of water vapor in clean ion-free air, the nuclei of atmospheric condensation, the growth of droplets in cloud and fog, the initial stages of ice formation, the formation of snow crystals, the physics of natural precipitation processes, and other problems are discussed. ***B. J. Mason.*** 481 pp. 1957. Oxford Press, London. (QC921 M38p)

9268* Advances in Modern Oceanology. Discusses the complex study of the ocean, the geological investigation of its bottom, the circulation of water masses, the biological structure, and the ocean as regulator of the chemical condition of the atmosphere. The first oceanographic congress was described. (*In Russian.*) Uspekhi Sovremennoĭ Okeanologii. ***L. A. Zenkevich and D. I. Shcherbakov.*** *Priroda,* v. 49, no. 4, Apr. 1960, p. 56-63.

9269 Advances in Meteorite Research. Report on the 8th Conference of Meteorites. ***E. L. Krinov.*** *Rand Corporation, Translation T-117,* July 7, 1959, 3 pp. (From *Vestnik Akademii Nauk SSSR,* no. 8, 1958, p. 118-119.) Rand Corporation, Santa Monica, Calif.

9270* Toxicology and Oceanography. Covers such subjects as the risks of professional intoxication by sea products, venomous fish, venomous aquatic invertebrates, reptiles, shells, the risks connected with adulterated fishing products or with defective canning. Prophylatic precautions and corrections are suggested. (*In French.*) Toxicologie et océanographie. ***René Fabre.*** *Revue Générale des Sciences Pures et Appliquées,* v. 67, nos. 1-2, Jan.-Feb. 1960, p. 11-38.

9271 Randomized Cloud Seeding in Santa Barbara. The Effectiveness of Cloud Seeding During a Period of Three Years Is Statistically Evaluated. Distinct conclusions about re-

sults from seeding cannot yet be made. A striking feature is that the unexpectedly high proportional increases in precipitation are not due to very heavy amounts of mix on the target from seeded clouds but to the fact that spectacularly low amounts fell when there was no seeding. ***Jerzy Neyman, Elizabeth L. Scott, and Marija Vasilevskis.*** *Science*, v. 131, Apr. 15, 1960, p. 1073-1078.

9272 On the Thermal Boundary Layer of the Ocean. Measurement of the long-wave infrared radiation from the top 0.1 mm of the evaporating ocean demonstrates the existence of a cool surface layer characterized by departures of as much as 0.6 C from the "surface temperature" found by conventional methods. Being very thin, the layer cools sufficiently rapidly to re-establish itself in less than 12 seconds after disruption by a breaking wave. ***Gifford Ewing and E. D. McAlister.*** *Science*, v. 131, May 6, 1960, p. 1374-1376.

9273 Earthquake Mechanisms. It is widely agreed that the energy released as seismic waves was gradually stored as potential energy of strain before the shock. The moot question is just how this strain energy is transformed into the kinetic energy of wave motion. ***Perry Byerly.*** *Science*, v. 131, May 20, 1960, p. 1493-1496.

9274 Sand. Geologist defines it as particles of rock between .05 and two millimeters in diameter. The shape of sand grains, transported by water and wind, is a clue to their history. ***H. Kuenen.*** *Scientific American*, v. 202, no. 4, Apr. 1960, p. 95 + 14 pages.

9275* Why Observe Stellar Eclipses? From eclipsing binaries a great deal can be learned about the sizes and masses of stars, the structure of stellar atmospheres, and even about the internal structure of stars. ***Alan H. Batten.*** *Sky and Telescope*, v. 19, no. 8, June 1960, p. 464-466.

9276* Application of Gamma-Ray Logging Data in Solving Certain Geological Problems. From gamma well logging data collected in Central and East Cis-Caucasus it was concluded that maxima of gamma activity were confined to finely disperse argillaceous rocks enriched in organic substance. The accumulation of these rocks took place in an environment of H_2S and sulphide-siderite geologic facies. (*In Russian.*) Ob ispol'zovanii dannykh gamma-karotazha dlia resheniia nekotorykh voprosov geologii. ***S. S. Itenberg.*** *Sovetskaia Geologiia*, v. 3, no. 3, Mar. 1960, p. 106-112.

9277* On the Detailed Exploration of Deposits Preparatory to Commercial Development. Certain problems of successive conduction of prospecting-exploration work, and a detailed exploration of various deposits are considered. States that the correct solution of these problems essentially increases the efficiency of geological exploratory work. (*In Russian.*) O deiatel'nosti razvedki mestorozhdenii peredavaemykh v promyshlennoe osvoenie. ***P. S. Matveev and A. V. Nikiforov.*** *Sovetskaia Geologiia*, v. 3, no. 3, Mar. 1960, p. 113-119.

9278 Some Results of the Determination of the Structural Parameters of the Atmosphere Using the Third Soviet Artificial Earth Satellite. ***V. V. Mikhnevich, B. S. Danilin, A. I. Repnev, and V. A. Sokolov.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA-TT-*F-13, May 1960, 19 pp. (TL570 Un3tm Vis.)

9279 The Determination of the Density of the Atmosphere at an Altitude of 430 Kilometers by the Sodium Vapor Diffusion Method. The experiment was carried out with a rocket. In the rocket heat were located two Na evaporators, each containing two kg of metallic Na and a corresponding quantity of thermite. The Na vapor was ejected into the atmosphere through a nozzle. A succession of photographs of the Na cloud was made. All photographs were calibrated. ***I. S. Shklovskiy and V. G. Kurt.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA-TT-*F-15, Apr. 1960, 13 pp. (TL570 Un3tm Vis.)

9280 On the Problem of the Interaction Between a Satellite and the Earth's Magnetic Field. ***Yu. V. Zonov.*** *U. S. National Aeronautics and Space Administration, Technical Translation, NASA TT-*F-37, May 1960, 11 pp. (TL570 Un3tm Vis.)

9281* The Trade-Wind Inversion as a Transoceanic Duct. Radiosonde data for stations in the South Atlantic trade-wind belt are analyzed to determine the potentialities of the trade-wind inversion as an elevated duct for transoceanic radio transmission. These were supplemented by refractometer soundings made by an aircraft during the latter part of 1958. These records indicate that a duct is generally present. ***M. Katzin, et al.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation*, v. 64D, no. 3, May-June 1960, p. 247-253.

9282* Focusing, Defocusing, and Refraction in a Circularly Stratified Atmosphere. Focusing, defocusing, astronomical refraction and path length of rays as a function of the departure angle of the ray at the source is described for cases with the source outside, inside, or on the boundary of a circular stratification. ***K. Toman.*** *U. S. National Bureau of Standards Journal of Research, Section D, Radio Propagation*, v. 64D, no. 3, May-June 1960, p. 287-288.

9283* Application of Carbon and Cellulose-Carbon Replicas to the Study of Fracture Surfaces of Mineral Aggregates. The best results for aggregates of soft powdery minerals, many belonging to the oxidation zone, are obtained from one-stage carbon replicas with a preliminary shading with Pt. With compact aggregates, two stage cellulose-carbon replicas are recommended. The replica method reveals the structures of replacement of one mineral by another. (*In Russian.*) Primenenie ugol'nykh i tselliulozo-ugol'nykh replik k izucheniiu poverkhnosteĭ izloma mineral'nykh agregatov. ***G. S. Gritsaenko, A. I. Gorshkov, and K. E. Frolova.*** *Vsesoiuznoe Mineralogicheskoe Obshchestvo, Zapiski*, pt. 89, 2nd ser., no. 2, 1960, p. 152-159.

See also: **8746** (Proceedings, World Petroleum Congress); **8749** (soil stabilization).

GRAPHIC ARTS

9284 Photogrammetry—Developments and Applications: 1958. Presented at the Thirty-Seventh Annual Meeting, Jan. 6-10, 1958, of the Committee of Photogrammetry. Adjustment of state plane coordinates, survey security through photogrammetry, earthwork data procurement by photogrammetric methods, 10-foot portable subtense bar, aerial mapping, photographic targets for markers, photogrammetric map accuracy are reported and discussed. *Highway Research Board, Bulletin* 199, 1958, 82 pp. (TE1 H53b Contin.)

9285* Speed Rating of Reversible Color Films. Data obtained from some psychophysical tests have resulted in a simple sensitometric method of rating film speeds which is essentially based on the exposure represented by the midpoint of a straight line connecting net densities of 0.20 and 2.00 on the characteristic curve. ***Spencer R. Albro and Ira B. Current.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 65-68.

9286* Two Psychophysical Methods for Evaluating the Quality of Projected Color Slides. The exposure indexes of reversal color materials for use in miniature cameras are normally based on the results of judgments made of the quality of projected slides which differ only in the exposure given. These slides are presented to judges in either of two ways—in the order of increasing or decreasing exposure or in a random order with respect to exposure. The advantage appears to be with the ordered-sequence presentation. ***W. Woodbury.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 69-73.

9287* A Glass Screen Halftone Sensitometer. Exposure of halftone dot patterns on film test samples is required in the evaluation of "lith" -type films and processing systems used in the graphic arts industry. Discussed here is a simple, compact optical system which will effectively simulate any set of optical conditions obtainable in a process camera. A prototype halftone sensitometer using this system is described. ***Raymond Alfaya.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 74-77.

9288* An Automatic Gamma-Ray Sensitometer Using Cobalt-60 Foil Sources. A sensitometer is described for exposing film between lead-foil intensifying screens in a four-step sensitometric series, using thin cobalt-60 foils as the radioactive sources. With source activities totaling about 7 millicures, exposure times for industrial-type X-ray film range from 10 to 200 sec. Shielding is sufficient to reduce the radiation to a factor of two or three above background. ***V. G. McInnch and H. M. Cleare.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 78-85.

9289* A Method of Measuring Nonlinear Distortion Caused by Photographic Lenses. A method has been described which yields from a single exposure the amplitude response for a single selected frequency across the entire field, as well as the phase characteristics of the lens. With this method we can evaluate the nonlinear distortion of the lens. ***Kojiro Kinoshita, Hidehisa Sato, and Sizuo Tatuoka.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 86-89.

9290* Photographic Problems Associated With the Construction of a Large Computer Memory. A large electronic information processing unit for use in telephone switching has been built. It uses a semipermanent memory which stores binary information on photographic plates. High-contrast emulsions have been found very suitable for information storage and for construction of the access system. ***M. B. Purvis and G. V. Deverall.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 90-96.

9291* Influences of Some Addition Agents on the Color of Developed Silver From Liquid Photographic Emulsion. The influence of alkyl homologues of 6-alkyl-7-hydroxy-5-methyl-1,3,4-triazaindolizine, 2-alkyl-1,3,4-oxadiazoline-5-thione, and 2-alkyl-5-amino-1,3,4-oxadiazole on the color of the developed silver image was investigated with a liquid silver chloride emulsion developed by a dilute Phenidone–hydroquinone developer. The color became more blue-black with increasing number of carbon atoms in the alkyl group of the triazaindolizine but with decreasing number of carbon atoms in the alkyl group of the oxadiazoline-5-thione. ***Kyoshi Futaki, Yasushi Ohyama, and Toh-Ichi Iwasaki.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 97-100.

9292* Photographic Development by Hydroquinone Compounds With Positively Charged Groups. Positively charged substituents on hydroquinone developers considerably decrease the induction period of photographic development. Chromatographic elution adsorption tests on silver bromide sols are in accordance with the pnotographic development results. ***J. F. Willems.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 101-109.

9293* The Stability of Concentrated Ammonium Thiosulfate Solutions at High Temperature. Sodium and ammonium thiosulfate liquors were stored in sealed glass tubes at 60 C. The stability rapidly decreased as the pH value and sulfite concentration were lowered. Sulfite reacted with the thiosulfate and when all the sulfite was consumed the thiosulfate decomposed. ***G. I. P. Levenson.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 110-112.

9294* Color Balance and Camera Lens Color. Camera lenses transmit radiant energy of different wavelengths selectively. Lenses differ particularly in their transmission of ultraviolet energy, and these differences affect the color balance of color transparencies made by photography with the lenses. ***F. C. Williams and F. Grum.*** *Photographic Science and Engineering*, v. 4, no. 2, Mar.-Apr. 1960, p. 113-114.

9295 Developments in Electrographic Printing. The electographic printing method for evaluating porosity and cracking in protective-coating systems on metals is described and discussed. Electrographic printing makes use of a small direct current to transfer ions from the base metal through discontinuities in the coating to a chemically treated dye-transfer paper. A pressure device is used during passage of the current to hold the material firmly against the treated paper. Color changes locate precisely cracks and pores in the coating. ***H. R. Miller and E. B. Friedl.*** *Plating*, v. 47, May 1960, p. 520-527.

9296* Paper Properties and the Printing Process. For every printing process there are certain physical properties that paper should have in order to produce the most satisfactory result. Offset and gravure requirements, possible improvements in the near future are discussed. ***Walter W. Roehr.*** *Productionwise*, v. 15, no. 3, Apr. 1960, p. 24 + 1 page.

9297 High-Speed Spectrograph Shutter. An electromechanical shutter is described to open and close a 20-μ spectrograph slit in 5 μsec with a delay of 20 μsec. The shutter incorporates a movable slit which is propelled across the stationary spectrograph slit by the thermal expansion of a Joule-heated hairpin-shaped Nichrome wire. ***John C. Camm.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 278-279.

9298 Methods of Appraising Photographic Systems. I. Historical Review. Reasons for the unsuitability of resolving power as a criterion of the performance of an optical or photographic system in general are outlined and the newer concepts of acutance and spread function are introduced. The method of computing the edge trace from the spread function is described. ***Fred H. Perrin.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Mar. 1960, p. 151-156.

9299 Interpretation of Dimensional Changes in Cellulose Ester Base Motion-Picture Films. The factors which affect the dimensions of solvent-cast, cellulose ester base motion-picture film are discussed in order to correct some of the misinterpretations that are sometimes made. The distinction between standard film dimensions at the time of manufacture and actual film dimensions at the time of use is clarified. ***Peter Z. Adelstein and John M. Calhoun.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Mar. 1960, p. 157-163.

9300 A New Convertible Projector for 35mm and 70mm Film. A projector of basically new design is intended for the dual purpose of projecting either 35mm or 70mm film, at either 24 or 30 frames/sec. The different projection lenses are prefocused in precision fittings for ready interchange. ***Willy Borberg and Bernard D. Plakun.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Mar. 1960, p. 176-178.

9301* A New Positive Developer. A positive slow developer PM with sharply decreased concentration of the developing substances and bromides was prepared. For a 35 mm black-and-white positive moving-picture film, the average developing time was 4 mm, the contrast efficiency was 2.3 $\pm$ 0.10. (*In Russian.*) Novyĭ positivnyĭproiavitel'. ***S. M. Antonov and G. G. Dvigubskii.*** *Tekhnika Kino i Televideniia*, 1960, no. 4, Apr., p. 45-52.

HEAT POWER

9302 Combustion of Highly Reactive Fuels in Supersonic Airstreams. The feasibility of adding heat to supersonic airstreams by combustion was studied in a small wind tunnel. Aluminum borohydride, pentaborane, hydrocarbon-aluminum borohydride mixtures, trimethylaluminum, diethylaluminum hydride, alkylboranes, alkylboron hydrides and vinylsilane were tested. The first three ignited easily and burned well. The others either failed to ignite or burned only in the diffuser. ***Edward A. Fletcher, Robert G. Dorsch, and Harrison Allen, Jr.*** *ARS Journal*, v. 30, Apr. 1960, p. 337-344.

9303 Analysis of Operation of Simplest Ramjet Combustion Chamber Under Flying Conditions. Finds that the results of Talantov's calculations are qualitatively correct, although the degrees of some of the effects noted in the figures, are questionable with respect to the real engines. Thus, the reviewer believes that the result of this paper should be considered only for the purpose of predicting qualitative trends for ramjet length requirements which have already been established by development experience. ***A. V. Talantov.*** *ARS Journal*, v. 30, Apr. 1960, p. 379-385.

9304 Thermoelectric Cooling and Power Generation. Introduction of thermoelectric generators and refrigerators to agricultural engineers that they may be better able to judge the proper time to employ them in their respective fields of application. ***C. S. Duncan.*** *Agricultural Engineering*, v. 41, May 1960, p. 293-295.

9305 Perspective on Direct Power Conversion. The development of useful fuel cells for electric power generation again hinges upon extensive materials research. Additional information is needed on the physical and chemical properties of fused salts. ***S. Peter Kaprielyan.*** *Aircraft and Missiles*, v. 3, May 1960, p. 22-24.

9306 Testing Solid-Propellant Rocket Motors. Finished units can be checked for bonds at case-to-liner, and liner-to-propellant interfaces; checking "grain" soundness is next step. ***R. E. Klient and R. D. McCown.*** *Aircraft and Missiles*, v. 3, May 1960, p. 30-33.

9307 Diesel Ramjet Design. A new approach departs from conventional circular venturi; octagonal shape to cause multiple-shock flow and effect ignition by compression. ***Ronald A. Cole.*** *Aircraft and Missiles*, v. 3, May 1960, p. 50-51.

9308 Applications of Thermoelectricity. The Kelvin relations, theory of thermoelectric devices, thermoelectric properties of semiconductors, the figure of merit for a semiconductor, the selection of semiconductors, semiconductor alloys, preparation and evaluation of materials, applications of the Peltier effect, and thermoelectric generation are discussed. ***H. J. Goldsmid.*** 118 pp. 1960. John Wiley & Sons, New York. (TK2950 G57a)

9309* N.S.U-Wankel Engine. Design of the rotary-expansion power unit. ***R. F. Ansdale.*** *Automobile Engineer*, v. 50, May 1960, p. 166-167.

9310* Chevrolet Air-Cooled Engine. A six-cylinder, air-cooled engine. *Automobile Engineer*, v. 50, May 1960, p. 188-190.

9311 Continental Develops New Multifuel Diesel Engine. Essentially a four-stroke, overhead valve Diesel engine, LDS-427 is characterized as a "multifuel" engine, capable of burning any of the fuels usually available in U. S. military field depots, without making any changes or adjustments in the engine. ***Joseph Geschelin.*** *Automotive Industries*, v. 122, no. 11, June 1, 1960, p. 36 + 2 pages.

9312* Reduction of the Wall Temperature of Heat Exchangers by Means of Longitudinal Ribbed Tubes. The ribbed tube offers the possibility of varying the wall temperatures of heat exchangers. The quantitative relationships are derived and the possibilities resulting from them are explained, using the example of an oil-heated air preheater for cupola furnaces and the heating of bitumen. (*In German.*) Senkung der Wandtemperaturen von Wärmeübertragern durch Längsrippenrohre. ***Erich Hensel.*** *Chemie-Ingenieur-Technik*, v. 32, Apr. 1960, p. 258-260.

9313 Design and Performance of Gas Turbine Power Plants. High Speed Aerodynamics and Jet Propulsion. Combustion chamber, requirements and processes, experimental techniques, fuel injection, flame stabilization, mixing processes, fuels for aircraft gas turbine engines, combustion chamber development, mechanics of materials for gas turbine applications, flutter problems in gas turbines, and performance are discussed. ***W. R. Hawthorne and W. T. Olson, editors.*** v. XI. 563 pp. 1960. Princeton University Press, Princeton, New Jersey. (TL709 H53)

9314* Investigation Into Nozzle Hole Blockage in High-Speed Diesel Engines. The following engine factors promote hole blockage: high injector temperature, rough surface finish inside the nozzle hole, sticking of the injector needle. Fuel quality can affect hole blockage. Selected fuel additives can reduce the nozzle blocking tendency of fuels. ***G. McConnell.*** *Gas and Oil Power*, v. 55, no. 663, Apr. 1960, p. 99-103.

9315 Experiments on Two-Stroke Exhaust Ports Under Steady and Unsteady Flow Condiitons. Studies the discharge from an engine cylinder to atmosphere. The objective was to establish suitable data for the design of exhaust ports. Two theoretical methods were used; in the first method the discharge was analysed by the method of characteristics and it was shown that the discharge was by wave action. The second method neglected the particle velocity in the cylinder. ***R. S. Benson.*** *Institution of Mechanical Engineers, Proceedings*, v. 173, no. 19, 1959, 36 pp.

9316* A Method of Approximating the Calculation of Temperature Fields in Cooled Disc Rotors of Gas Turbines. With the proposed method radial temperature drop, arising when the apparatus is started and in established heat conditions can be determined quickly and with sufficient accuracy, and maximum temperature for the latter case can be assessed. (*In Russian.*) Metodika priblizhennogo rascheta temperaturnykh poleĭ v okhlazhdaemykh diskovykh rotorakh gazovykh turbin. ***E. I. Molchanov.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 3, no. 4, Apr. 1960, p. 99-102.

9317 Two-Shaft or Single-Shaft Gas Turbines for Your Compressor Station. The difference between the two types, operating conditions, single-shaft turbine operation, two-shaft turbine operation, multiple turbine stations, and fuel consumption are discussed. ***J. L. Mangan and T. C. Heard.*** *Oil and Gas Journal*, v. 58, no. 21, May 23, 1960, p. 107 + 6 pages.

9318* Two-Stroke Exhaust System Experiments. A certain amount of tangential and axial inclination of the exhaust port is beneficial. It should be relatively low and should be carefully matched with that of the inlet ports. ***T. J. Williams and F. D. Robinson.*** *Oil Engine and Gas Turbine*, v. 28, May 1960, p. 18-20.

9319* Four Lines Figure Gas-Turbine Cycle. For a speedy choice of the right gas-turbine cycle for any given application. Charts calculate and record all studies of alternate cycles. ***John Kreitner.*** *Power*, v. 104, June 1960, p. 72-75.

9320* Gain in Engine Output and Fuel Economy Shown in Diesel Power Costs Today. Two new design principles—turbocharging and turbocooling—have been basically responsible for the present trend to higher hp per cylinder and more fuel economy for both 2-cycle and 4-cycle engines. ***W. R. Crooks.*** *Power Engineering*, v. 64, May 1960, p. 50-52.

9321* The Thirteenth Louis Bleriot Lecture. Current Problems in Aero Engine Design. Present trends, types of engine required, engines for supersonic transport, the high temperature problem, lines of development are discussed. ***E. S. Moult.*** *Royal Aeronautical Society, Journal*, v. 64, May 1960, p. 259-272.

9322 Solar-to-Electric Energy Conversion. Measured potentials of experimental cells are low, but warrant further consideration. Research to reduce high internal resistance should pay off in higher maximum power per unit electrode area. ***Bert H. Clampitt and Dale E. German.*** *SAE Journal*, v. 68, May 1960, p. 52-54.

9323 Solid Propellent and Exothermic Compositions. Deals with the use of chemicals as a source of energy, especially in connection with explosives and rocket propulsion. Objective is to survey the wide range of chemical compositions which have been developed as sources of energy. Covers aspects of the subject which previously have not been dealt with in detail. ***James Taylor.*** 153 pp. George Newnes Ltd., London. (QD516 T21s)

9324 Propellant Vaporization as a Design Criterion for Rocket-Engine Combustion Chambers. Vaporization rate can be increased by decreasing drop size, initial velocity, and contraction ratio or by increasing chamber and nozzle length, pressure, and initial propellant temperature. ***Richard J. Priem and Marcus F. Heidmann.*** *U. S. National Aeronautics and Space Administration Technical Report, NASA* TR-R-67, 1960, 127 pp. (TL521 Un3ra Vis.)

See also: **8648** (fuel cell-powered tractor).

INFORMATION—PREPARATION AND DISSEMINATION

9325 Scientific Firm Finds Technical Library Invaluable. Describes the library at the Wayland Laboratory of the Raytheon Co. ***Alice G. Anderson.*** *American Business*, v. 30, Apr. 1960, p. 18-19.

9326 The Cataloging-In-Source Experiment. A Report to the Librarian of Congress by the Director of the Processing Department. This report describes an experiment of having

publishers print in their current publications facsimiles of Library of Congress catalog cards. These cards were supplied by pre-publication cataloging at the Library of Congress. The conclusion was reached that cataloging-in-source is not economically feasible. 199 pp. 1960. Library of Congress, Washington. (Z695 Un3.4c)

9327 Closed-Circuit TV Equipment as Used in a Decentralized Library Situation. Discusses the choice of system, choice, and description of equipment, installation, method of operation, maintenance and putting together a system. ***Roger P. Bristol.*** 13 pp. 1958. Alderman Library, University of Virginia, Charlottesville, Va. (Z716.8 B77cc)

9328* Guide to Reference Material. Books in the fields of philosophy and psychology, religion, social sciences, languages, science and technology, mathematics and natural sciences, applied sciences, the arts, literature, geography, biography, history, exploration and travel are cited. ***A. J. Walford and L. M. Payne, editors.*** 543 pp. 1959. The Library Association, Chaucer House, Malet Place, London. (ZZ711 W14g Ref.)

9329* Cross Referencing Industrial Engineering Projects. The Kimberly-Clark Corporation has found an economical procedure for cross referencing reports from several mill locations. This procedure is used for current dissemination of project information, for reviewing past projects for pertinent information, and for administration of Industrial Engineering activities. ***Karl E. Aldinger.*** *Journal of Industrial Engineering*, v. 11, no. 3, May-June 1960, p. 241-243.

INSTRUMENTATION

9330 Principles of High-Temperature Microscopy. Designs of microscope systems of long working distance and with numerical apertures of 0 or greater are available and have been shown to be suitable for studying microstructures at temperatures above 750 C. ***Byron B. Brenden, H. W. Newkirk, and J. L. Bates.*** *American Ceramic Society, Journal*, v. 43, May 1960, p. 246-251.

9331* Temperature Measuring Devices. A survey of available devices. ***J. J. Combes.*** *Automation*, v. 7, May 1960, p. 87-95.

9332 Fourth International Conference on Electron Microscopy, Proceedings. Physical-Technical Part. Cathodes, lenses and deflection systems, specimen equipments, methods of picture reproduction, photographic emulsions, stereo-photography, vacuum, radiation stress, electron microscopes, reflection- and emission-electron microscopes, interferential microscopy and interferometry, the projection X-ray microscope, X-ray microanalyzer and the X-ray scanning microscope, Moiré patterns, diffractions, and many other problems are discussed. (*In German.*) Vierter Internationaler Kongress für Elektronenmikroskopie, Verhandlungen. Physikalisch-Technischer Teil. ***G. Möllenstedt, H. Niehrs, and E. Ruska, editors.*** v. I, 851 pp. 1960. Springer-Verlag, Berlin. (QH211 In8p)

9333 Industrial Instrument Servicing Handbook. Pressure-measuring, differential pressure-measuring, velocity and volumetric measuring, liquid-level-measuring, temperature-measuring, viscosity and specific-gravity, and pH and redox measuring instruments; gas analyzers; control valves and value positioners; speed measurement and control; and other problems are discussed. ***Grady C. Carroll.*** Sections individually paged. 1960. McGraw-Hill, New York. (TA165 C23i)

9334 Resistance Temperature Detectors. The principle of operation of resistance temperature detectors is based on the fact that the electrical resistance of metals increases directly with temperature, and is reproducible to a high degree of accuracy. The resistance temperature detectors are usually used in Wheatstone bridge circuits. ***Victor W. Rose.*** *Instruments and Control Systems*, v. 33, May 1960, p. 790-793.

9335 Calibrating Thermocouples. National Bureau of Standards methods for calibration of Pt versus Pt-Rh, Cu-constantan, Chromel-Alumel, and Fe-constantan theromcouples are described. ***Wm. F. Roeser.*** *Instruments and Control System*, v. 33, May 1960, p. 796-797.

9336 Temperature-Probe Response Time. Highest accuracy measurements involve the response of the transducer and the specific heat and thermal conductivities of the probe materials and surrounding media. The author proposes to rate transducer response time in terms of 63 and 90% recovery of a step-function temperature change for three liquid media—static water, liquid Ar, and ambient air to liquid Ar. ***Alvin B. Kaufman.*** *Instruments and Control Systems*, v. 33, May 1960, p. 804-807.

9337 C-R Arbitrary-Function Generator. Construction of a cathode-ray-tube-type function generator is described and its applications are shown. Time scale generator, C-R circuit and pattern reproduction, vertical amplifier, power supplies, commercial oscilloscope are discussed. ***Yujiro Yamamoto.*** *Instruments and Control Systems*, v. 33, May 1960, p. 808-810.

9338 Direct-Reading Resistance Thermometer Bridge. I.-II. Describes the basic circuitry for a high-precision, direct-reading resistance thermometer with dials calibrated in degrees C and any standard Pt resistance thermometer as sensing element. A circuit was developed which, through linear variations of the resistance elements, gives a quadratic law having the form $R = R_0(1 + AT + BT^2)$, where B is negative, as required for a Pt thermometer. Details circuitry and construction for a direct-reading resistance thermometer was built utilizing the design criteria formulated. By using any standard 25.5 Ω Pt resistance thermometer as a sensing element, the bridge gives subdivision of the temperature scale to 0.001 C between −50 and +700 C with an accuracy, exclusive of that of the thermometer, of ±0.001 C. I. ***T. M. Dauphinee and H. Preston-Thomas.*** II. ***T. M. Dauphinee, C. G. M. Kirby, and H. Preston-Thomas.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 253-263.

9339 Resistance-Heated High Vacuum Furnace for Temperatures to 1400°C. An experimental high vacuum furnace with a Pt-Rh resistance heating element is described; it is operable also in O_2 or other gases up to pressures of at least 10^{-3} mm Hg. The furnace is assembled from readily obtainable equipment and knife-edge vacuum seals are used throughout. The power required for 1400 C is about 1 kw. ***Julius Cohen.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 267-270.

9340 Development of a Special Thermocouple for Measuring Transient Temperatures Within a Solid Body. A special thermocouple was developed to measure transient temperatures at relatively large distances within the walls of uncooled rocket nozzles. The device, known as a thermoplug, was designed to cause a minimum disturbance of the temperature field. Results of limited experiments indicate the design to be adequate for the purpose for which it was developed. ***Joseph D. Clem, Jr.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 334-336.

9341 A Versatile Recording Potentiometer. A Brown "Electronik" recording potentiometer was modified to provide a versatile instrument that can be applied to a variety of problems without time-consuming changes. Ranges may be selected in six spans, from 0.5 to 100 millivolts. No adjustments of amplifier gain are required when switching from one range to another. Zero suppression is continuously variable over a ±100 millivolt range by means of coarse and vernier controls. Cold junction compensation is provided for four standard thermocouples, and chart speeds from ½ to 16 inches per hour may be selected at will. ***C. O. Ballou.*** *U. S. Atomic Energy Commisison, DP-441*, Feb. 1960, 19 pp. (UF767 Un3.1dp Contin.)

9342 A High-Temperature Metal Resistance Furnace for Vacuum or Pressure Operation. A metal resistance furnace is described for operation to 3000 C *in vacuo* or at pressures to 100 atmospheres of inert or reducing gas. Tungsten or Ta heater tubes give a uniform heating chamber approximately one inch in diameter by three inches long. ***M. R. Nadler, J. E. Runyan, and C. P. Kempter.*** *U. S. Atomic Energy Commission, LAMS-2393*, Dec. 1959, 17 pp. (UF767 Un3.1La Contin.)

9343* The Measurement of Low Partial Gas Pressures With the Mass Spectrometer. Factory produced mass spectrometers under normal operating conditions with partial pressures as low as 1.10^{-11} micron can be measured whereby the

resolving power $M/\Delta M$ of the instrument is 250. The calibration was made by means of a gas input measurement. The partial pressures obtained after adequate baking of the whole analyzer system are stated, whereby both mercury- and oil-diffusion pumps were used. It is discussed how partial pressures down to 1.10^{-14} micron can be measured. (*In German.*) Messung niedriger Partialdrucke mit dem Massenspektrometer. ***H.-W. Drawin and C. Brunnée.*** *Vakuum-Technik*, v. 9, no. 3, Apr. 1960, p. 65-72.

LUBRICATION AND FRICTION

9344 Microchemistry in Lubricating Oil Analysis. Microanalytical methods for determining the viscosity, pour point, specific gravity, and ash content are discussed. ***F. M. Roberts.*** *Iron and Steel Engineer*, v. 37, May 1960, p. 84-87.

9345 Marine Lubrication. Lubrication of main propulsion machinery and auxiliary machinery are discussed in detail. ***G. H. Clark.*** 635 pp. 1959. Simmons-Boardman Publishing Corp., New York. (VM763 C54m)

9346 How To Predict Wear Life of Rolling Surfaces. No need to go back to comparable designs for a guide—use these equations to compute life expectancy of gears, cams, bearings, clutches and links. ***Donald J. Myatt.*** *Product Engineering*, v. 31, no. 19, May 9, 1960, p. 44-47.

9347 Transience of the State of Wear by Repeated Rubbing. It is concluded that the transition of the state of wear is mainly due to the gradual accumulation of worn particles on the rubbing surface but not to the formation of any particular surface layer or to variation of surface roughness. ***Toshio Sata.*** *Wear*, v. 3, no. 2, Mar.-Apr. 1960, p. 104-113.

9348 Friction and Lubrication in Engines, in Particular With Added Colloidal Graphite. The corrosive action of HP additives and moisture on the surface of cast iron cylinder walls and the vulnerability of the Beilby layer are discussed. HP additives do not interfere with the beneficial effects of graphite. (*In German.*) Reibung und Schmierung im Maschinenbau, insbesondere bei zusätzlicher Verwendung von Kolloidal-Graphit. ***J. U. Augustin.*** *Wear*, v. 3, no. 2, Mar.-Apr. 1960, p. 114-121.

9349 Fatigue Phenomenons of Antifriction Bearings. A review is given of investigations to date on pitting of antifriction bearings and of resulting hypotheses in order to obtain a general view of the whole problem. (*In German.*) Zur Frage der Ermüdungserscheinungen bei Wälzlagern. ***H.-H. Schreiber and G. Ulsenheimer.*** *Wear*, v. 3, no. 2, Mar.-Apr. 1960, p. 122-143.

MECHANICAL ENGINEERING

9350 The Strength of Thick Cylinders Subjected to Repeated Internal Pressure. Tests were made on cylinders made from a carbon steel, a 3 per cent chrome steel, an austenitic stainless steel, a light alloy, a nearly pure titanium, the Ni-Cr-Mo steel in a harder state, and both the Ni-Cr-Mo steel and the chrome steel in the nitrided condition. ***J. L. M. Morrison, B. Crossland, and J. S. C. Parry.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 2, May 1960, p. 143-153.

9351* The Bending and Twisting of a Flat Elastic Plate With a Reinforced Circular Hole. The reinforcement is chosen so that the ratio of its radial width to the diameter of the hole is small; this implies that there is no radial stress variation across sections of the reinforcement. Using the classical theory for bending, expressions are obtained for the boundary conditions at the junction of the reinforcement and plate. ***R. Hicks.*** *Aeronautical Quarterly*, v. 11, pt. 2, May 1960, p. 137-158.

9352* Experimental Investigation of the Stalled Flow of a Single-Stage Axial Flow Compressor. The stall cell patterns of this compressor stage are described in detail and changes of slope in stage temperature and pressure rise characteristics are explained in terms of stall propagation. Strain gage tests on stator blades are used to indicate the possibility of large dynamic stresses occurring when the stall cell frequency is equal to the blade natural bending frequency. ***M. D. Wood, J. H. Horlock, and E. K. Armstrong.*** *Aeronautical Quarterly*, v. 11, pt. 2, May 1960, p. 159-170.

9353* Some Simple Transformation Functions for Square and Triangular Holes With Rounded Corners. Transformation functions, in the form of three-term polynomials, are derived for the conformal mapping of the region outside a square or an equilateral triangle, having rounded corners with varying and controllable degrees of curvature, on to the region outside the unit circle. ***W. H. Wittrick.*** *Aeronautical Quarterly*, v. 11, pt. 2, May 1960, p. 195-199.

9354 Preliminary Flight Experiments With the Princeton University 20-Ft. Ground Effect Machine. As far as controllability is concerned, it is evident that better longitudinal and lateral control is desirable; however, directional control seems to be quite adequate. It also seems reasonable from results presented that there is good agreement between the shape of the model augmentation ratio curve and that of the full-scale machine. ***W. B. Nixon and T. E. Sweeney.*** *Aero/Space Engineering*, v. 19, Apr. 1960, p. 32 + 5 pages.

9355* Topological Aspects of Structural Linear Analysis. Improving the conditioning of the equations of compatibility of a multi-member skeletal structure by use of the knowledge of topology. ***J. C. de C. Henderson.*** *Aircraft Engineering*, v. 32, May 1960, p. 137-141.

9356* Fatigue Resistance. Design Considerations. Contrary to the general conception of adding weight for fatigue resistance it is sometimes possible to reduce the fatigue hazard by removing weight. The theory of having bearing area, tear-out area, and tension area sufficient to develop the full shear strength of a rivet is not necessarily sound when fatigue life is considered. Accordingly, marked improvements in fatigue resistance can be achieved by reducing the underlying areas to such an extent that they are incapable of inducing loads causing fatigue failures of the main structure. Results of tests involving fatigue failure are given, and seven basic considerations in the design of fatigue resistant structures are listed. ***C. R. Smith.*** *Aircraft Engineering*, v. 32, May 1960, p. 142-144.

9357* Effect of Floor Concrete Strength on Column Strength. Tests indicated that the column strength is a function of the ratio of column concrete strength to floor concrete strength and the number of restrained edges tributary to the column. ***Albert C. Bianchini, Robert E. Woods, and Clyde E. Kesler.*** *American Concrete Institute, Journal*, v. 31; *ACI Proceedings*, v. 56, no. 11, May 1960, p. 1149-1169.

9358* Stress Waves. The two types of waves, dilatational and distortional, which are propagated in an elastic medium, are discussed. Some uses of stress waves, such as determining explosive and impact force-time curves and measuring the physical properties of materials, are indicated. ***H. F. L. Pinkney.*** *Canadian Aeronautical Journal*, v. 6, no. 4, Apr. 1960, p. 133-140.

9359* Simplified Gear Calculations. Design data for spur gear measurement is presented, together with some simplified methods of calculation for the designer who is occasionally called upon for such work. ***W. A. A. Witham and A. G. Beaveridge.*** *Engineering Materials and Design*, v. 3, Apr. 1960, p. 212-217.

9360 How to Design and Buy Investment Castings. ***Robert H. Herrmann, editor.*** 165 pp. 1959. Investment Casting Institute, Chicago, Ill. (TS233 H43h)

9361 Industrial Packaging. Scope of industrial packaging, corrugated and solid fibreboard, folding cartons and set-up boxes, shipping sacks, nailed wooden boxes and crates, wirebound and cleated containers, cylindrical shipping containers, wrapping, barrier, and cushioning materials, fastenings and closure, bundling and reinforcing methods, easy-opening devices, marking, labeling, coding methods, and packaging equipment are discussed. ***Walter F. Friedman and Jerome J. Kipnees.*** 536 pp. 1960. John Wiley & Sons, New York. (TS158 F91i)

9362 An Introduction to the Mechanics of Solids. Fundamental principles of mechanics; introduction to mechanics of deformable bodies; forces and moments transmitted by slender members; stress and strain; stress-strain-temperature relations; torsion; stresses and deflections due to bending; stability of equilibrium; buckling. ***Stephen H. Crandall and Norman C. Dahl, editors.*** 444 pp. 1959. McGraw-Hill, New York. (TA350 M38i)

9363 Flexural Vibrations of Elastic Sandwich Plates. Recently developed flexural theory of elastic sandwich plates includes the effects of transverse shear deformations, rotatory and translatory inertias, and flexural and extensional rigidities, with no limitations imposed upon the magnitudes of the ratios between the thicknesses, material densities, and elastic constants of the core and faces. On the basis of this sandwich plate theory and the exact elasticity theory, flexural vibratons of sandwich plates are investigated. ***Yi-Yuan Yu.*** *Journal of the Aero/Space Sciences,* v. 27, Apr. 1960, p. 272-282.

9364 The Electromagnetic Drive. One method of obtaining adjustable output speed from a constant-speed motor is the electromagnetic coupling, or eddy-current coupling. The electromagnetic drive is simple in construction and requires a minimum of maintenance. It provides a wide speed range. ***R. P. Bleikamp.*** *Machine Design,* v. 32, May 12, 1960, p. 180-184.

9365 Evaluating Performance Curves of Torque Converters. Performance of a proposed engine-coverter combination can be estimated by a study of the output performance curves of the unit. Converter characteristics which affect performance at extreme speed ratios can also be evaluated. Five methods of developing performance curves are explained. ***R. W. Bachmann and M. W. Dundore.*** *Machine Design,* v. 32, May 12, 1960, p. 188-198.

9366 Non-Homogeneity in Elasticity and Plasticity. Proceedings of Symposium of International Union of Theoretical and Applied Mechanics held in Warsaw, Sept. 2-9, 1958. Elasticity, plasticity, rheology, dynamics, wave propagation, and statistical and micro nonhomogeneity are discussed in articles in English, French, and German. ***W. Olszak, editor.*** 528 pp. 1959. Pergamon Press, New York. (QA931 In8n)

9367 Electrical Analog Simplifies Heat-Flow Analysis. Electrical circuits serve as simulators that predict behavior of the product under a large variety of complex thermal conditions. ***Morton Sklaroff.*** *Product Engineering,* v. 31, no. 18, May 2, 1960, p. 39-41.

9368* The Moiré Method in Photoelasticity. Technique, used in the Laboratory of Photoelasticity at the University of Liège, provides rapid and precise determination of the total basic constraints and results in the separation of these constraints in the whole model. (*In French.*) Considérations sur la méthode du moiré en photoélasticité. ***A. Pirard.*** *Revue Universelle des Mines,* v. 16, ser. 9, Apr. 1960, p. 117 + 23 pages.

See also: **9309** (N.S.U.-Wankel engine); **9310** (Chevrolet Convair engine).

METALLURGY

9369 ASTM Standards on Light Metals and Alloys. Aluminum and aluminum-base alloys, wrought products for electrical purposes, magnesium and magnesium-base alloys and general methods of testing are discussed. 5th Ed. 358 pp. 1960. American Society for Testing Materials, Philadelphia. (TA480.A6 Am35L5)

9370 Why Stainless Steel Is Used for Process Piping. The weldability of various grades of stainless steel are briefly discussed. Different kinds of corrosion are described. A short review of the many industrial applications for stainless steel piping systems is given. ***Arthur C. Wicker.*** *Heating, Piping & Air Conditioning,* v. 32, May 1960, p. 127-130.

9371 The Nature and Properties of Transition Metal Hydrides. Review Article. Discussions of the phases present in metal-hydrogen systems, their crystal structures, pressure-composition-temperature relations, thermodynamic properties, and electrical and magnetic properties. ***G. G. Libowitz.*** *Journal of Nuclear Materials,* v. 2, no. 1, Mar. 1960, p. 1-22.

9372* Investigations of Niobium Alloys With Tantalum. Sintered and subsequently rolled Nb - Ta alloys are examined over the entire composition range. Their hardness, strength and elongation at room temperature, specific electrical conductivity, electrochemical behavior and corrosion resistance are reported. The mechanical properties show no maximum. (*In German.*) Untersuchungen an Niob-Tantal-Legierungen. ***H. Braun, K. Sedlatschek, and R. Kieffer.*** *Journal of the Less-Common Metals,* v. 1, no. 6, Dec. 1959, p. 413-419.

9373 Magnesium and Its Alloys. Physical properties of magnesium, alloy theory and properties, magnesium alloy systems, the deformation of magnesium, time-temperature-dependent alloy phenomena, casting alloys and technology, wrought alloys and technology and other problems are discussed. ***C. Sheldon Roberts.*** 230 pp. 1960. John Wiley & Sons, New York. (TN799.M2 R54m)

9374 Aluminium and Its Alloys in 1959. Attention is drawn to work published reporting research and technical progress in the various aspects of the metallurgy of Al and its alloys, including extraction, founding, fabrication, constitution, properties and standardization. Reference is also made to interesting applications of these materials. ***E. Elliott.*** *Metallurgia,* v. 61, Mar. 1960, p. 123-132.

9375* The Preparation and Properties of High-Purity Chromium. Preparation of pure Cr, melting and casting, powder metallurgy, working, physical properties, mechanical properties, age-hardening characteristics, brittleness, preparation and properties of single crystals, and corrosion properties are discussed. ***A. R. Edwards, J. I. Nish, and H. L. Wain.*** *Metallurgical Reviews,* v. 4, no. 16, 1959, p. 402-449 + 2 plates.

9376 The Metallurgy of Hafnium. Application, extraction from ores, reduction processes, refining, melting, fabrication and shaping, physical metallurgy and properties, and analytical chemistry of Hf are discussed together with hafnium alloy systems and the thermodynamic properties of Hf and its compounds. ***D. E. Thomas and E. T. Hayes, editors.*** 384 pp. 1960. United States Atomic Energy Commission, Washington 25, D. C. (TN799.H5 Un3.1m)

9377 Metallurgy of the Rarer Metals. Pt. 7. Beryllium. Occurrence and uses of Be; production of beryllium oxide from beryl; beryllia; production of beryllium metal, fabrication, physical and mechanical properties, chemical reactivity, alloys and compounds, effect of a minor alloying addition, and nuclear properties; health hazards and their control; determination of O in Be. ***G. E. Darwin and J. H. Buddery.*** 392 pp. 1960. Academic Press, Inc., New York. (TN798 M56)

9378* Recycling Zircaloy Scrap. Large quantities of zircaloy are used for cladding fuel elements and as structural components in nuclear reactors. To conserve material and to reduce costs, solid scrap and ingot conditioning chips can be treated and remelted. ***B. F. Rubin and R. F. Gessner.*** *Metal Progress,* v. 77, no. 4, Apr. 1960, p. 97-100.

9379* New Uses for Stainless Steel. Stainless steel is making gains in new fields and extending existing markets. New fabricating techniques are broadening applications in automotive, architectural, industrial, and other areas. ***George C. Kiefer.*** *Metal Progress,* v. 77, no. 4, Apr. 1960, p. 120-122.

9380* Criteria for Selecting Metals Used in Chemical Plants. Newer metals and improved alloys will broaden the horizons of the chemical processing industry. ***George A. Nelson.*** *Metal Progress,* v. 77, no. 5, May 1960, p. 80 + 14 pages.

9381* Molybdenum—A Material for Steel Extrusion Dies. Molybdenum makes a good die material for hot extrusion because of its high-temperature strength at extrusion temperatures. It is comparatively easy to machine and is resistant to galling during extrusion of steel. ***W. L. Steinbrenner.*** *Metal Progress,* v. 77, no. 5, May 1960, p. 116-120.

9382* Development of High-Strength Niobium Alloys for Elevated-Temperature Applications. A study to improve the

elevated-temperature strength of Nb by alloying resulted not only in greatly improved strengths at 1200 and 1470 F but also in the development of improved fabrication techniques for these alloys. Tensile tests on the cold-worked materials at 1200 and 1470 F indicate that Cr and Zr are both potent strengtheners of Nb. Limited welding studies indicate that strong and reasonably ductile welds can be produced both by arc- and spot welding. ***John A. De Mastry, Frederic R. Shober, and Ronald F. Dickerson.*** *U. S. Atomic Energy Commission, BMI-*1417, Feb. 22, 1960, 22 pp. (UF767 U3b Contin.)

9383 Development of Thorium-Uranium-Base Fuel Alloys. Thorium-uranium alloys were studied with the aim of developing alloys with improved irradiation behavior by control of microstructure. The effect of Th purity, melting technique, hot and cold working, and heat treatment on microstructure was investigated. The most significant microstructural differences occurred as a result of casting technique. The arc-melted alloys exhibited the most nearly ideal structure, that of a homogeneous dispersion of small-diameter U particles in a Th matrix. It was found that small additions of Mo or Nb were effective in stabilizing the gamma-uranium phase, while Zr was an effective hardener at temperatures up to 600 C. ***Martin S. Farkas, Arthur A. Bauer, and Donald F. Dickerson.*** *U. S. Atomic Energy Commisison, BMI-*1428, Mar. 18, 1960, 28 pp. (UF767 U3b Contin.)

See also: **8638** (materials for nonmelting heat-sink systems).

METALS—CORROSION

9384 Materials of Construction for Equipment Used With Hydrogen Peroxide. Materials of construction are evaluated in 90% by weight hydrogen peroxide. Test results are reported on pure metals, Al and its alloys, stainless steel, miscellaneous alloys, polyethylene and halogenated polyethylenes, PVC and copolymers, silicone rubbers, miscellaneous plastics, synthetic oils and greases, and miscellaneous materials. ***Ralph Bloom, Jr., Lorne E. Weeks and Charles W. Raleigh.*** *Corrosion,* v. 16, Apr. 1960, p. 100-106.

9385 A Laboratory Evaluation of Zinc Anodes in Sea Water. Experimental technique and procedures employed on the anodic polarization of Zn alloys are described. Within the range of compositions tested, the preferred zinc anode alloy is shown to be one containing 0.3 to 0.6% Al with the iron content controlled for the range 0.001 to 0.005%. ***J. A. H. Carson, W. L. M. Phillips, and J. R. Wellington.*** *Corrosion,* v. 16, Apr. 1960, p. 107-113.

9386 Corrosion Prevention by the Deoxygenation of Water by the Desorption Method. Corrosion of boilers can be prevented by the deoxygenation of boiler water by desorption. The water undergoing deoxygenation is mixed with a gas which contains no O_2. After the conclusion of the diffusion process, the gas and O_2 are automatically removed from the water, regenerated and again returned to the system. ***P. A. Akol'zin.*** *Corrosion,* v. 16, Apr. 1960, p. 114-116.

9387 The Analysis and Composition of Aluminum Corrosion Products. A Report of NACE Technical Unit Committee T-3B on Corrosion Products. Reported methods of analysis include X-ray diffraction, X-ray fluorescense, differential thermal analysis, electrographic methods, spectrographic analysis, microscopic examination, and qualitative and quantitative tests. *Corrosion,* v. 16, Apr. 1960, p. 117-123.

9388 The Oxidation and Corrosion of Zirconium and Its Alloys. The breakdown of the oxide films formed on C-melted Zr and Zircaloy-2 was studied using optical and electron microscopes. The nature of the breakaway process is illustrated and an explanation is offered for the effect of tin, iron, chromium, and nickel alloying additions on corrosion resistance of C-melted Zr. ***B. Cox.*** *Corrosion,* v. 16, Apr. 1960, p. 124-128.

9389 Oxidation Behavior and Protection of Refractory Metals. Relative oxidation behavior and degree to which oxide properties affect the oxidation resistance of Cb, Ta, Mo, W, and Re are presented. ***Chester T. Sims.*** *Corrosion,* v. 16, Apr. 1960, p. 129-133.

9390 Kinetics of Absorption by Metals of Hydrogen From Water and Aqueous Solutions. Rate formulae are derived and compared with experimental data. The rate in acid solutions is proportional to the square root or the cube root of the acid concentration. The rate in water vapor is proportional to the square root of the water vapor pressure or independent of the water vapor pressure. ***T. G. Owe Berg.*** *Corrosion,* v. 16, Apr. 1960, p. 134-136.

9391 Corrosion Inhibitor Evaluation at Elevated Temperatures. Inhibitors were designed for down-the-hole treatment of producing oil and gas wells. The evaluations at elevated temperatures were compared to the evaluations of the same inhibitors run at room temperature. ***Victor W. Maxwell.*** *Corrosion,* v. 16, Apr. 1960, p. 137-140.

9392 The Corrosion and Oxidation of Metals: Scientific Principles and Practical Applications. The approaches to corrosion, simple oxidation of single metal, effect of other elements on oxidation and film-growth, electrochemical corrosion, soluble inhibitors, bimetallic contacts and crevice corrosion, anodic corrosion and passivation, buried and immersed metal-work, H evolution and acid corrosion, crystallographic corrosion, H cracking and blistering, boilers and condensers, atmospheric corrosion, protection by paints and non-metallic coatings, metallic coatings and metal-pigmented paints, intergranular and stress corrosion, corrosion fatigue, other types of conjoint action, velocity measurement and testing, velocity of film-growth and of wet corrosion are discussed. ***Ulick R. Evans.*** 1094 pp. 1960. St. Martin's Press Inc., New York. (TA467 Ev15co)

9393 Design for Pipelines. I. Cathodic protection of 6-in. Haifa-Tel Aviv product line and 16-in. crude-oil line is described. ***D. Spector.*** *Corrosion Technology,* v. 7, Apr. 1960, p. 103-106.

9394 Basic Requirements of Corrosion Control. Recent developments in marine cathodic protection have produced automatic static, solid-state polarization control systems. Methods are now available for providing complete, continuous protection of all underwater portions of a ship's hull. ***Warren O. Clark.*** *Corrosion Technology,* v. 7, Apr. 1960, p. 114-117.

9395 Effect of Adsorption of Polar Organic Compounds on the Reactivity of Steel. Rate studies were made for the oxygen-free reaction between steel powder and 1 *N* H_2SO_4, both uninhibited and inhibited. The retardation of the reaction by organic polar compounds was influenced more markedly by molecular structure than by molecular weight or area. ***Howard F. Finley and Norman Hackerman.*** *Electrochemical Society, Journal,* v. 107, Apr. 1960, p. 259-263.

9396 Mechanism of the Iron-Hydrogen Sulfide Reaction at Elevated Temperatures. The corrosion scale was composed of two layers: a thin dense layer adjacent to the metal and a porous layer with a coarse crystalline structure. These two features, which differentiate this reaction from the iron-sulfur vapor reaction, are interpreted on the basis of (a) partial blocking of reaction sites by hydrogen produced during attack, and (b) continuous recrystallization of the dense scale into a porous scale. ***Hans Arm, et al.*** *Electrochemical Society, Journal,* v. 107, Apr. 1960, p. 264-271.

9397 How Temperature, Treatment, and Velocity of Potable Water Affect Corrosion of Copper and Its Alloys. Tests show that maximum corrosion for a given velocity does not occur at the highest temperature, but at about 170 F. Corrosion is least noticeable with sodium zeolite softened water; the amount of corrosion increases with velocity increase. ***Malvern F. Obrecht and Laurence L. Quill.*** *Heating, Piping & Air Conditioning,* v. 32, May 1960, p. 105-113.

9398 Methods of Obtaining Improved Outdoor Corrosion Resistance With Nickel + Chromium Plate. The outdoor corrosion resistance of Cr plated, polished Watts Ni is compared with that of bright Ni, and the following systems of composite plates. Bright, crack-free Cr on Ni or Cu+Ni plate. The usual 0.01 mil Cr on dual or duplex Ni plate; Cr plate on Ni or Cu+Ni; Cr+Ni+Cr composite deposits. ***H. Brown and D. R. Millage.*** *Institute of Metal Finishing, Transactions,* v. 37, pt. 1, Spring, 1960, p. 21-27.

9399 Factors Influencing the Corrosion Resistance of Decorative Plating on Zinc-Alloy Die Castings. Variations in surface structure or the presence of minor defects on plated

castings which are still commercially acceptable from the point of view of appearance do not significantly influence service performance. A clear improvement in resistance to blistering with thicker Cr is evident. ***Osman J. Jones, V. E. Carter, and J. Edwards.*** *Institute of Metal Finishing, Transactions,* v. 37, pt. 1, Spring, 1960, p. 40-49.

9400 Corrosion of Steels in Liquid Bismuth and Lead. The corrosion of a variety of steels in liquid Pb and Bi has been studied in the temperature range 600-900 C by measuring weight losses of steel pins after immersion in the hot side of a thermal convection loop. In uninhibited Bi, low-alloy steels are more resistant to corrosion than 13% Cr-Fe or 18-8 stainless steel. ***J. A. James and J. Trotman.*** *Iron and Steel Institute, Journal,* v. 194, pt. 3, Mar. 1960, p. 319-323.

9401* The Nature and Growth of Interaction Layers Formed During the Reaction Between Solid Titanium and Liquid Aluminum. During the interaction of solid Ti and liquid Al, the interacting layers were observed to develop an unusual cruciform pattern. The constituents of the layers were identified as Al and $TiAl_3$ by microhardness, metallographic and X-ray techniques. ***J. Mackowiak and L. L. Shreir.*** *Journal of the Less-Common Metals,* v. 1, no. 6, Dec. 1959, p. 456-466.

9402 The Effect of Composition and Structural Condition on the Resistance of 18-2 Chrome-Nickel Steels to Electrochemical Attack. The influence of chemical composition on the percentage delta-ferrite present in the microstructure of 18-2 Cr-Ni steels is discussed and is related to the factor of corrosion resistance. An investigation into the failure of two pump shafts, and series of immersion tests of selected steels coupled to a Cu-base alloy in seawater, produced information on the mechanism of breakdown and indicate a superior resistance to attack when a wholly martensitic structure is achieved. ***G. Newcombe.*** *Metallurgia,* v. 61, Mar. 1960, p. 107-112.

9403 Stop Corrosion on Magnesium. Electroless Ni, porcelain enameling, clear anodize, DOW 17 anodize impregnation process, ferric nitrate bright Ni, Sn-plated fasteners, new organo-Sn inhibitor, and compatible aluminum alloys are only a cross section of the advancements made recently in the corrosion protection of Mg. ***P. F. George.*** *Precision Metal Molding,* v. 18, May 1960, p. 69-71.

9404 Summary of Corrosion Investigations on High-Temperature Aluminum Alloys. A compilation of corrosion studies performed during the period February, 1955, to October, 1957, to evaluate Al alloys developed for use as cladding material for fuel elements in pressurized water-cooled reactors at temperatures ranging from 500 to 600 F. The alloy compositions included bases 2S Al containing Ni, Ni and Fe, and special alloys of Al and Cu. Studies of the most promising alloys of Al and Ni were extended to include corrosion-irradiation environments in the test loops at MTR, and boiling heat transfer conditions in heat through-put loops at ANL. ***C. R. Breden and N. R. Grant.*** *U. S. Atomic Energy Commission, ANL-5546,* Feb. 1960, 72 pp. (UF767 Un3.1an Contin.)

9405 A Study of the High-Temperature Air Oxidation of Yttrium Metal. Corrosion of the Y metal was very slow at 450 C, but increased rapidly with temperature, becoming very severe at 925 C. Oxidation was found to increase the hardness of Y metal due to the diffusion of O into the metal lattice. ***O. N. Carlson, F. A. Schmidt, and R. L. Wells.*** *U. S. Atomic Energy Commission, IS-115,* Mar. 1960, 32 pp. (UF767 Un3.1isu Contin.)

See also: **8940** (corrosion of gas pipe lines).

METALS—EXTRACTION AND REFINING

9406 Kinetics of Vacuum Induction Refining—Theory. The kinetics of vacuum distillation, vacuum-melt surface reactions, crucible-melt surface reactions and boiling are analytically investigated. The theory focuses attention upon measureable parameters rather than upon the adjustable parameter, stagnant layer thickness, associated with other theories. ***E. S. Machlin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 314-326.

9407 Metallurgical Aspects of the Basic Oxygen Process. Considerable knowledge was gained through experience and investigation of practices and methods for obtaining good contol of temperature, slag condition and steel analysis in this process. ***L. W. Frech.*** *Blast Furnace and Steel Plant,* v. 48, May 1960, p. 452-455.

9408 Blast Furnace, Coke Oven, and Raw Materials Committee of the Iron and Steel Division, Proceedings. Proceedings of the St. Louis meeting, April 6-8, 1959. Coal, raw materials, blast furnace theory, coke, processed blast furnace burdens, coal chemicals, blast furnaces, and coke ovens are discussed. The Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Proceedings, v. 18, 344 pp. 1960. The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York. (TN713 Am35p Vis.)

9409 Production of Constructional Steels in Arc Furnace With Oxygen Injection. The introduction of more lime during the meltdown in arc furnaces and injection of O decreased considerably the content of P in steel. The magnesia content in the slag indicates no extra erosion of hearth when O was injected. ***S. M. Gnuchev, V. P. Frantsov, G. F. Morenko, G. K. Komissarov, and Z. V. Klochkova.*** *Henry Brutcher Translation No.* 4113, 14 pp. (From *Stal',* v. 17, no. 3, 1957, p. 228-232.) Henry Brutcher, Altadena, Calif.

9410 Effect of Vibrations on Quality of (Rimmed-Steel) Ingots. Optimum conditions of vibration for higher pouring rates of rimming steel and improved ingot structure were investigated. ***V. F. Kravchenko, S. Énekes, K. G. Trubin, and E. V. Abrosimov.*** *Henry Brutcher Translation No.* 4759, 21 pp. (From *Izv. Vuz, Chern. Metall.,* 1959, no. 7, July, p. 23-34.) Henry Brutcher, Altadena, Calif.

9411 Change in Structure and Properties of Aluminum and Its Alloys When Treated With Ultrasonic Vibrations. Gas inclusions in Al alloys can be removed by ultrasonic vibrations. The mechanical properties of castings can be improved by treating the melt with ultrasonic vibrations. ***M. B. Al'tman, B. I. Slotin, N. P. Stromskaya, and G. I. Eskin.*** *Henry Brutcher Translation No.* 4776, 11 pp. (From *Izv. Akad. Nauk SSSR, OTN, Metall. i Toplivo,* 1959, no. 3, May-June, p. 88-91.) Henry Brutcher, Altadena, Calif.

9412 Effect of Steel Composition and Deoxidizing Practice on Phosphorus Segregation. The minimizing of the harmful effects of P in steel with special reference to action of Si, C and various deoxidizers is discussed. The effect of deoxidation of steel with 0.3% Al is also discussed. ***O. D. Moldavskii.*** *Henry Brutcher Translation No.* 4784, 5 pp. (From *Izv. Akad. Nauk SSSR. OTN, Met i Topliva,* 1959, no. 5, Sept.-Oct., p. 126-127.) Henry Brutcher, Altadena, Calif.

9413 Elimination of Hydrogen and Nitrogen From Steel Baths by Flushing With Argon. It was found that by injecting Ar at a rate of 2 cu.m STP/m.ton (minute) into molten steel during the final stage of the basic arc furnace process, [H] can be reduced drastically, and [O] can be reduced slightly. ***M. Imai, T. Watanabe, Y. Katayama, T. Nakayama, and K. Oi.*** *Henry Brutcher Translation No.* 4789, 5 pp. (From *Tetsu to Hagané,* v. 43, no. 3, 1957, p. 45-46.) Henry Brutcher, Altadena, Calif.

9414 Heat Transfer in Zone of Secondary Cooling of Continuous Steel Casting Installations. A method of calculation of heat extraction coefficients is described and the effect of intensity of secondary cooling on character of solidification discussed. Figures and tables are cited. ***A. D. Akimenko and A. A. Skvortsov.*** *Henry Brutcher Translation No.* 4796. 13 pp. (From *Nauchn. Doklady Vyssh. Shkoly - Metallurgiya,* 1959, no. 2, Apr.-June, p. 123-130.) Henry Brutcher, Altadena, Calif.

9415 Cooling With Ore (Instead of Scrap) in the Oxygen Top Blowing LD Process. Results obtained with the use of ore instead of scrap as a coolant of 0.04-0.70% carbon steels by the LD process are reported. ***K. Grünberg, W. Schleicher, and R. Kunz.*** *Henry Brutcher Translation No.* 4800, 10 pp. (From

Stahl und Eisen, v. 80, no. 5, 1960, p. 277-281.) Henry Brutcher, Altadena, Calif.

9416 The Gaseous Reduction of Fine Iron Ores. The reduction by H of fine iron-ore particles, sized between 50 and 260μ, was studied. The particles were reduced while suspended as a dispersed cloud in the reducing gas. ***S. Y. M. Ezz and R. Wild.*** *Iron and Steel Institute, Journal*, v. 194, pt. 2, Feb. 1960, p. 211-221.

9417* Theory and Practice of Deoxidation of Steel. Fusible products of deoxidation are easily wetted by molten steel and come slowly to its surface. Heat resistant products of deoxidation are not easily wetted by molten steel and coagulate and come rapidly to its surface. Steel deoxidation by increased quantities of Al cause a decrease in its "endogenous" microscopic inclusions (oxides and globules). (*In Russian.*) Teoriia i praktika raskisleniia stali. ***N. N. Dobrokhotov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia*, v. 2, no. 10, Oct. 1959, p. 23-28.

9418* Effects of Remelting in the Vacuum Arc Furnace on the Properties of a Refractory Nickel Based Alloy. By using the vacuum arc furnace it is possible to obtain ingots without surface defects. The volume of the shrinkage hole is very restricted, porosity beneath the crust, flaws, etc., are absent; remelting guarantees in the melt a decrease of C, S, O, and N content. The nonmetallic inclusions decrease considerably. The particles of the inclusions are softer and uniformly distributed throughout the metal. (*In Russian.*) Vliianie pereplava v dugovoĭ vakuumnoĭ pechi na svoĭstva zharoprochnogo splava na nikelevoĭ osnove. ***V. A. Sheremet'ev.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia*, v. 2, no. 10, Oct. 1959, p. 43-48.

9419* World's Largest Vacuum Induction Furnace. A description of the construction and operation of the nation's first 5000-lb vacuum induction furnace is given here. Several engineering innovations make this a versatile, capable installation. ***J. W. Byrne.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 83-86.

9420* Investigations of the Operation of a Large Circle-Shaped Low-Blast Furnace. A comparative experiment at 11 m. charging height with very coarse charging material, the main experiment with 6.5 m. of feeding height and with small blast furnace charge and coarse coke, other experiments and rating of the results are discussed. (*In German.*) Untersuchungen über den Betrieb eines grossen runden Niederschachtofens. ***Kurt Säuberlich and Georg Brückner.*** *Neue Hütte*, v. 5, Mar. 1960, p. 137-143.

9421* The Character and Possibilities for Application of Smelting in Suspension. Techniques and experience, effect on construction of furnaces, cyclone- and suspension smelting as modern steps in the development of metallurgy, reducing processes in the suspension, and other problems are discussed. (*In German.*) Charakter und Anwendungsmöglichkeiten des Schwebeschmelzens. ***Alfred Lange.*** *Neue Hütte*, v. 5, Mar. 1960, p. 149-160.

9422* Non-Combustion Recuperation of the Gases Resulting From Refining With Pure Oxygen (CAFL and IRSID Processes). Tests based on tapping the gases arising from pure O_2 refining have been effected by C.A.F.L. and I.R.S.I.D. with a converter of five tons capacity at the new pilot station at Maizières-lés-Metz. The two processes have made it possible to perform this tapping effectively and to recover gases rich in Co. (*In French.*) Récupération sans combustion des gaz provenant d'affinage a l'oxygène pur procédés C.A.F.L. & irsid. ***Marc Allard and Gérald Namy.*** *Revue de Métallurgie*, v. 57, Mar. 1960, p. 207-220.

9423* Continuous Determination of the Bath Temperature During Basic-Bessemer Conversion. The use of a Ni-Cr-constantan radiation thermophile sighting onto the bath through the converter mouth makes it possible to follow with precision the thermal changes taking place in basic-Bessemer charges blown with ordinary air. Detailed examination of the temperature records as a function of the metallurgical data gives a deeper understanding of the chemical changes in basic-Bessemer charges, particularly at the end of decarburization and at the drop of the flame. (*In French.*) La mesure continue de la température du bain en cours de conversion thomas. ***I. Harreng, J. Hancart, and J. Marot.*** *Revue de Métallurgie*, v. 57, Mar. 1960, p. 221-238.

9424* A New Blast Furnace With a 9 m Hearth Diameter. Dumping trials are basis for design of the top of the large blast furnace at the August Thyssen-Hütte at Duisburg-Hamborn; the large blast furnace and its auxiliary equipment; operation of the furnace; first results of the operation. (*In German.*) Ein neuer Hochofen mit 9 m Gestelldurchmesser. ***Christoph Winters.*** *Stahl und Eisen*, v. 80, no. 8, Apr. 14, 1960, p. 465-473.

9425* Distribution of the Burden Within the Blast Furnace and Some Possibilities for Its Control. Fundamental investigations of phenomena occurring in dumping; experiments carried out on blast furnace model 1:20; investigations on charging model 1:1; application of the experimental results to the operation of the blast furnace. (*In German.*) Die Verteilung de Beschickung in Hochofen und einige Möglichkeiten zu ihrer Beeinflussung. ***Gerhard Heynert, Friedrich Toussaint, Jr., Jacob Willems, and Günter Quade.*** *Stahl und Eisen*, v. 80, no. 8, Apr. 14, 1960, p. 473-483.

9426* Influence of the Steel-Making Method and Processing on Pitting Corrosion of Shipbuilding Steel. Natural layers covering the surface of rolled steel, scale and descaling, structure of shipbuilding steels and their relative freedom from slag inclusions, effect of the chemical composition, and other problems are discussed. (*In German.*) Einfluss der Stahlherstellung und Stahlverarbeitung auf den Lochfrass von Schiffbaustahl. ***Gerhard Becker and Walter Dick.*** *Stahl und Eisen*, v. 80, no. 8, Apr. 14, 1960, p. 491-497.

9427 The Influence of Lubrication on the Compactability of Magnesium-Green Salt Blends for Bomb Reduction. Sufficient lubrication of the die surfaces during the final compacting of blends of uranium tetrafluoride (UF_4) and Mg is necessary to prevent Mg from seizing to the die walls. Thick lubricants such as mineral oil and Dag 217 were the most effective in preventing seizing over a period of time because they remained on the die surfaces longer than did the more fluid lubricants. Punch clearance had little or no effect on the seizing problem. ***Stan J. Paprocki, Ronald J. Carlson, and Edward G. Smith, Jr.*** *U .S. Atomic Energy Commission, BMI*-1193, June 18, 1957, 16 pp. (UF767 U3b Contin.)

9428* Separation Possibilities of Alloyed and Coated Heavy Metals With Mercury. A study covering the separation of Cu-Ni alloys, the examination of the solubility of Cu in Hg, the separation of hard Zn and hard Pb. Cu-Ni alloys, hard Pb, tinned and galvanized Fe materials can be separated almost quantitatively, although the extraction is not yet possible on a commercial basis. Separation of Pb and Sb is interesting on a model basis only. (*In German.*) Trennungsmöglichkeiten von legierten und überzogenen Schwermetallen mit Quecksilber. ***Heinz Borchers and Kurt Stoffels.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 13, Apr. 1960, p. 165-169.

See also: **8732** (ferroalloy production); **9590** (blast-furnace technology).

METALS—FINISHING, POLISHING, AND CLEANING

9429* Automatic Polishing With Liquid Composition. Describes two machines with particular reference to their use of liquid polishing composition. Both are used to buff Cu-plated steel; Morrisflex-Hammond machine was also used to buff Ni plate. The thickness of Cu deposited is 1.5 mil and less than half of this is removed by the buffing. *Electroplating and Metal Finishing*, v. 13, Apr. 1960, p. 130 + 3 pages.

9430* The Pickling of Non-Ferrous Metals. Pickling methods for Cu and copper alloys, Al and aluminum alloys, Mg, Ni and nickel alloys, Ti, and mixed metals. Salt-bath discaling, plant for pickling, and pickling wastes are discussed. ***H. Silman.*** *Metallurgical Reviews*, v. 4, no. 16, 1959, p. 381-402 + 1 plate.

9431* How To Get the Most From Solvent-Vapor Degreasing. I. New equipment designed to use sprays, warm solvent baths and ultrasonics has expanded the basic method so that an even better job can be done. Equipment and applications are described. ***T. J. Kearney and C. E. Kircher.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 87-92.

9432* How To Get the Most From Solvent-Vapor Degreasing. II. Selection of solvents, the boiling range, compatability with the materials are discussed. ***T. J. Kearney and C. E. Kircher.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 93 + 5 pages.

9433* Superfinishing. Selection of abrasive materials; conditions of application, speeds, pressures and lubricants for different types of material. (*In Czech.*) Superfinišování. ***Jaroslav Hürek.*** *Strojírenská Výroba*, v. 8, no. 4, Apr. 1960, p. 153-159.

See also: **8948** (surface treatments for Mg).

METALS—FOUNDRY PRACTICE

9434 Effect of Primary Structure of [Low-Carbon] Steel on Susceptibility to Hot Tearing. A relationship was established between the susceptibility of low carbon steel to form hot cracks and its content of Al, Si or Cr. The plasticity of the steel at solidification temperatures exerts a marked influence on its susceptibility to the formation of hot cracks. ***O. D. Moldavskii and A. P. Pronov.*** *Henry Brutcher Translation No.* 4756, 12 pp. (From *Izv. Akad. Nauk SSSR, OTN, Metall. i Toplivo*, 1959, no. 3, May-June, p. 47-51.) Henry Brutcher, Altadena, Calif.

9435 Hydrodynamic Condition of Metal in Centrifugal Casting and Effect on Macrostructure. Variations in macrostructure of centrifugal castings, caused by various hydrodynamic states of the metal in the spinning mold were investigated. The effect of an increasing viscosity coefficient and of the thickness of the metal layer on the hydrodynamic state was examined. ***N. N. Reutor.*** *Henry Brutcher Translation No.* 4771, 22 pp. (From *Liteinoe Proizvodstvo*, v. 10, no. 6, 1959, p. 22-27.) Henry Brutcher, Altadena, Calif.

9436* Refining of Cast Iron by Oxygen and Lime Powder. Results of Irsid. Systematic investigation of injections of powered material, in particular of powdered lime, resulted in desulfurization of cast iron and improved blowing through the Thomas furnace. Blowing through the Martin furnace has interesting possibilities and must be investigated by proportioning the furnace charge. (*In French.*) Affinage de la fonte a l'oxygène et a la poudre de chaux. Résultats de l'irsid. ***B. Trentini, P. Vayssière, J. Francais, and M. Allard.*** *Fonderie*, no. 170, Mar. 1960, p. 79-88.

9437* Hydrodynamic, Fundamental and Practical Study of Feeder Systems With Multiple Attacks, Used in Sand Molding. Certain parameters were taken into account: convergence of the attacks, distance of the base of mold from the nearest point of attack, partition of the flow in the channel and attacks on the contraction coefficient and the jet angle on the exit of the attack; several other parameters are considered. (*In French.*) Étude hydrodynamique, fondamentale et pratique de systèmes d'alimentation a attaques multiples, utilisés en moulage sable. ***Michel Jeancolas, Georges Cohen de Lara, and Hubert Hanf.*** *Fonderie*, no. 170, Mar. 1960, p. 89-110.

9438 Die Design Improves Zinc Diecastings. Impact strength of zinc diecastings is discussed in relationship to features of die designs planned to produce optimum quality. Includes a resume of composition limits in zinc diecastings. ***George L. Werley.*** *Foundry*, v. 88, June 1960, p. 109-115.

9439* Gating and Feeding of Large Steel Castings. The gating and feeding are dependent upon certain basic principles connected with the solidification and cooling of steel and the conductivity and resistance to contraction of mold materials. These, however, are affected so much by factors of mold shape, design, etc., that, generally speaking, experience is the surest guide. ***Alan P. Riley.*** *Foundry Trade Journal*, v. 108, Apr. 21, 1960, p. 487-491.

9440* The Stress Cube, Its Design, Functioning, and Test Results Obtained With Cast Iron. Technological testing methods to determine the stresses, design of the test cube, functioning of the stress cube, and the process of stress formation; conclusions to be drawn for the design of castings are discussed. (*In German.*) Der Spannungswürfel, Aufbau, Wirkungsweise und Versuchsergebnisse an Gusseisen. ***Joseph Czikel.*** *Giesserei*, v. 47, no. 7, Apr. 7, 1960, p. 167-175.

9441* Nomogram for the Production of Grey Cast Iron. Diagrams of the mechanical properties; diagram of Laplanche; transportation diagram, application, possibilities for improvement are discussed. (*In German.*) Betriebsnomogramm für Grauguss. ***Wilhelm Patterson and Reinhard Döpp.*** *Giesserei*, v. 47, no. 7, Apr. 7, 1960, p. 175-180.

9442* The Use of Beryllium in Non-Ferrous Metal Castings. Beryllium bronzes (copper-beryllium alloys), Be as a deoxidizing and desulfurizing agent, Be as an accompanying element in metal melts are discussed. (*In German.*) Verwendung von Beryllium in NE-Metall-Gusswerkstoffen. ***Ernst Brunhuber.*** *Giesserei*, v. 47, no. 7, Apr. 7, 1960, p. 180-185.

9443* Determination of the Hydrogen Content in Aluminum Alloys by Means of the Telegas-Hydrogen Content Meter. Describes the determination of the gas contents of melts of an eutectic and hypereutectic aluminum-silicon alloy by means of the telegas hydogen content meter, as dependent on the degassing treatment, and a comparison of the results with values obtained by the specific weight quotient method and by the measurement of the specific weight. (*In German.*) Die Bestimmung des Wasserstoffgehaltes in Aluminiumlegierungen mit dem Telegasgerät. ***H. Plate.*** *Giesserei*, v. 47, no. 8, Apr. 21, 1960, p. 208-210.

9444* Cast Copper With High Conductivity. Copper must be melted with cuprous oxide or an oxygen carrier which does not affect the conductivity. Certain impurities can be entirely scorified; synthetic sand is the best mold material because its moisture is easily controlled. No correction of conductivity by annealing of Cu is necessary. Only the impurities of the surface are oxidized, so that the surface conductivity alone is modified. (*In German.*) Kupferguss mit hoher Leitfähigkeit. ***Friedrich Reile.*** *Giessereitechnik*, v. 6, Apr. 1960, p. 110-111.

9445* New Methods of Cast Iron Desulfurization Outside the Blast Furnace. The turbulence method described permits satisfactory contact between the metal and the desulfurizer consisting of 1.5 to 2.8% lime with 0.03 to 0.06% Al per weight of cast iron, resulting in 30 to 60% desulfurization. Suspended in air, the desulfurizer is more efficient than without a carrying gas. An ejector process connected with this method is described. (*In Russian.*) Novye sposoby vnedomennoĭ desul'furatsii chuguna. ***C. K. Sobolev, G. N. Oĭks, V. F. Isupov, V. M. Smetanin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, v. 2, no. 11, Nov. 1959, p. 13-18.

9446* Behavior of Phosphorous in the Open Hearth Furnace Bath During the Finishing Period. The optimum value of FeO increases with the increase in the basicity of the slag, apparently connected with the increase of the Fe_2O_3 concentration in the slag. Increased P_2O_5 content in the slag, at the same time increasing its fluidity and capacity of reaction, secures higher values of the relationship (% P_2O_5)/ (% P) currently accepted as the index of dephosphorization. (*In Russian.*) Povedenie fosfora v vanne martenovskoĭ pechi v period dovodki. ***A. I. Stroganov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, v. 2, no. 11, Nov. 1959, p. 23-29.

9447* Speed of Contact Melting. The energy of activation of contact melting (constant for a given system of specimens) is a characteristic of the contacting vapors. The pre-exponential multiplier of a given system of specimens depends on the conditions of testing: it increases with the decrease of the surface of contact and with the increase of the pressure on the specimens. (*In Russian.*) Sokorost' kontaknogo plavleniia. ***P. A. Savintsev, and A. V. Viatkina.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, v. 2, no. 11, Nov. 1959, p. 89-92.

9448* Concerning the Waste of Elements in Cast Iron Melting in the Cupola Furnace. Lowest loss (C-0%, Si-10%; Mn-12%) is observed during the melting of cast iron in the zone of maximum temperatures. The waste of C in viscous molten

cast iron is determined by the temperatures of the drops coming off the pigs. The higher the temperature, the lower the waste. The waste of Si decreases with decrease of the height of the level of pig melting in the reducing zone. It increases in the oxidizing zone. (*In Russian.*) Ob ugare elementov pri plavke chuguna v vagranke. ***A. V. Kaibichev and V. P. Chernobrovkin.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgie,* v. 2, no. 11, Nov. 1959, p. 113-118.

9449 Continuous Casting Machine for Copper Billet and Slab Production. The equipment handles Cu in all its various forms—from phosphorus de-oxidized and oxygen-free to fire-refined and tough-pitch types. The basic design of the machine also lends itself to the casting of brasses and bronzes, and aluminum and magnesium alloys. The shapes produced on the unit include round piercing and extrusion billets, square wire bars and rectangular slabs. The production capacity of the machine ranges from 3 tons/hr for double-strand casting of 3-in. diameter billets to 10 tons/hr for single-strand casting of 5½-in. x 33-in. slabs. *Metallurgiia,* v. 61, Mar. 1960, p. 101-102.

9450* White Iron Growth During Malleablizing. The quality of the iron was evaluated by X-ray, fracture and microstructure studies. The results show that decarburization during malleablizing substantially retards growth, carbon concentration in the absence of decarburization determines growth, and annealing variables have no effect on growth. ***N. R. Kelley and B. A. Ruediger.*** *Modern Castings,* v. 37, May 1960, p. 95-110.

9451* Shell Mixing Processes and Equipment for Quality Control of Resin Coated Sand. Describes the various types of coating processes and the relative merits of each process. Phenolic resins and sand testing are discussed as related to the coating processes cold, warm and hot coatings. ***John Albanese.*** *Modern Castings,* v. 37, May 1960, p. 111-114.

9452* Cast 70/30 Cupro-Nickel Inherent Characteristics. Properties were found to be markedly affected by Si content. Satisfactory weldability was obtained with low Si content. ***B. F. Shepherd.*** *Modern Castings,* v. 37, May 1960, p. 120-130.

9453* Porosity-Free Magnesium Alloy Castings Thermal Requirements. A thermal gradient of 5 F/in. must be established before the metal temperature falls more than approximately 50 F below the liquidus. ***R. D. Green.*** *Modern Castings,* v. 37, May 1960, p. 131-138.

9454* Plastic Patterns New Tools and Materials. During this period of development, epoxy plastic patterns were made by laminating sheets of glass cloth to build up the desired pattern thickness. The plastic used in this technique serves as the adhesive to cement or bond the sheets of cloth together, which results in a pattern structure of high strength. An alternate method is to cast or pour a liquid epoxy resin into a mold to form the pattern or core box. Casting or pouring plastic patterns is much faster than the laminating process. ***Frank Kobee.*** *Modern Castings,* v. 37, May 1960, p. 139-143.

9455* Grain Refinement of Copper. Two elements, Li and Bi, selected to produce constitutional supercooling, were effective in grain refining cast Cu. When sufficient Fe was dissolved to produce the peritectic, the effectiveness of this reaction was confirmed. ***G. C. Gould, G. W. Form, and J. F. Wallace.*** *Modern Castings,* v. 37, May 1960, p. 144-153.

9456* Low Pressure Die Casting. A method of low pressure die casting, described as flow against the force of gravity with slow cooling to complete solidification, is presented. Illustrations showing equipment are appended to the article. ***E. C. Lewis.*** *Modern Castings,* v. 37, May 1960, p. 154-158.

METALS—HEAT TREATMENT

9457 The Influence of Furnace Pressure Control on the Performance of Regenerative Reheating and Heat-Treatment Furnaces. The use of furnace pressure control to achieve marked fuel economies was shown in trials made on two gas-fired air-regenerative bogie-hearth furnaces where it was found that the gas consumed both in reaching temperature and in subsequent soaking is considerably reduced with increasing furnace pressure. This continues to obtain until an optimum pressure is reached, beyond which gas consumption again increases, although the effect of excessively high pressures is much less marked than correspondingly low pressures. ***J. A. Grainger and G. Wood.*** *Iron and Steel Institute, Journal,* v. 194, pt. 3, Mar. 1960, p. 307-319.

9458* Electrical Tempering of Steel 9KhS. A complex investigation of the transformations during electrical tempering of quenched steel 9KhS revealed that the first transformation during tempering in the interval of heating speed between 1000 and 8000 degree/sec occurs at 200-320 C; the third transformation at 530-670 C; the formation of austenite at 800-850 C. During electrical heating at 100-8000 degree/sec, the residual austenite is not decomposed. (*In Russian.*) Elektrootpusk stali 9KhS. ***V. T. Cherepin.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Cherenaia Metallurgiia,* v. 2, no. 11, Nov. 1959, p. 97-104.

9459* Furnaces and Installations for Nitriding and Carbonitriding. A survey of different methods of normal and soft nitriding, description of the design and use of gas-tight chamber furnaces, vat and shaft furnaces, salt baths and gas generators connected with the nitrogen hardening and dry cyaniding of steel. (*In Dutch.*) Ovens en inrichtingen voor het nitreren en carbonitreren. ***P. J. Kool and J. van der Linde.*** *Metalen,* v. 15, no. 7, Apr. 15, 1960, p. 115-119.

9460 Tube Annealing. Bright annealing of Cu and annealing most analyses of brass tubes in straight lengths and copper tube in coils. *Metal Industry,* v. 96, Apr. 1, 1960, p. 271 + 1 page.

9461* Modern Practice of Flame Hardening. Through suitable variations, any of the three methods for flame hardening now available (progressive, spinning and combination) can be used to harden the surface of practically any part. Unlike other case hardening methods, part size is not a limiting factor because surfaces are hardened selectively by local heating and quenching. ***M. R. Scott.*** *Metal Progress,* v. 77, no. 4, Apr. 1960, p. 69-73.

9462* The Flame Hardening of Gears. Steel gears of many sizes can be economically flame hardened if the proper procedure is employed. Article describes equipment, cost, and production problems faced by men in the field. ***John T. Howat.*** *Metal Progress,* v. 77, no. 4, Apr. 1960, p. 76-78.

9463* Heat Treatment of Mn-V-Mo Age-Hardenable Austenitic Steel. The age-hardening characteristics of Mn-V-Mo austenitic steels depend upon the temperature of the solution treatment. Optimum conditions for developing the full age-hardening potential of an alloy are ½-hr at 2100 F followed by a water quench. ***N. C. Howells and E. A. Lange.*** *Modern Castings,* v. 37, May 1960, p. 115-119.

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9464 The Life History of Individual Slip Lines During the Plastic Deformation of α-Brass Single Crystals. The results of average glide and density measurements of slip lines confirm an orientation effect observed in an earlier investigation. As an alternative, a mechanism involving cross-slip between a number of lines is proposed. The formation of cross-slip itself is discussed with reference to successive micrographs of selected areas. ***J. T. Fourie.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 88-96.

9465* Fatigue Fracture. Some Results Derived From the Microscopic Examination of Crack Surfaces. The nature of fine fracture striations is discussed. ***P. J. E. Forsyth and D. A. Ryder.*** *Aircraft Engineering,* v. 32, Apr. 1960, p. 96-99.

9466 Creep of Induim, Lead, and Some of Their Alloys With Various Metals. High-temperature creep experiments were carried out on In, Pb, and binary substitutional alloys In-Pb, In-Sn, In-Tl, In-Cd, In-Hg, Pb-Bi, Pb-Sn, Pb-In, and Pb-Cd. ***J. Weertman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 207-218.

9467 Effects of Grain Boundaries in Tensile Deformation at Low Temperatures. Single crystal, bicrystal and polycrystal tensile tests of Al at 4.2, 77, and 300 K were used to

examine the role of grain boundaries in the deformation process. Results indicate that a grain boundary may affect the extent and slope of easy glide. ***R. L. Fleischer and W. A. Backofen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 243-251.

9468 Plastic Deformation of Germanium by Alloying. Plastic deformation adjacent to the regrowth material was observed after alloying single crystal Ge with Sn. Of several solder alloys investigated, plastic deformation was observed only in the Ge samples in contact with Sn-doped regrowth material. ***W. J. Feuerstein.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Socety*, v. 218, no. 2, Apr. 1960, p. 251-254.

9469 Deformation Mechanisms and Work Hardening in Rhenium. The deformation modes are identified as those typical of the hexagonal metals, Ti, Zr, and Be. Slip is observed on $(10\bar{1}0)$, $(10\bar{1}1)$, and (0001) planes and twinning on $(11\bar{2}1)$, $(11\bar{2}2)$, and $(10\bar{1}2)$ planes. ***A. T. Churchman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 262-267.

9470 Magnetic Anisotropy and Magnetostriction of Ordered and Disordered Cobalt-Iron Alloys. The magnetostriction is large and positive for all alloys in both states of order (up to 150×10^{-6} for λ_{100} and 40×10^{-6} for λ_{111}). The magnetic anisotropy becomes zero near 41% Co for the disordered state. ***R. C. Hall.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 268-270.

9471 Effects of Radiation-Generated Helium and Tritium on the Properties of Aluminum-Lithium Alloys. Property changes produced by irradiation of Al-0.4 wt % Li alloys at 270 C to a burnup of 0.155% of all atoms are described. Metallographic evidence of the formation of internal pores and the concentration of gases at grain boundaries is shown. ***D. W. Lillie.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 270-277.

9472 The Mechanism of Beneficial Effects of Boron and Zirconium on Creep Properties of a Complex Heat-Resistant Alloy. A microstructural investigation was pursued to establish the mechanism of the pronounced benefits of traces of B and Zr on creep properties of a 55 Ni-20 Cr-15 Co-4 Mo-3 Ti-3 Al alloy at 1600 F. The mechanism of improvement of creep properties was found to be a pronounced stabilizing effect of traces of B and Zr on the grain boundaries of the alloy. ***R. F. Decker and J. W. Freeman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 277-285.

9473 Preliminary Internal Friction Measurements in Chromium. Low frequency-internal friction measurements on annealed Cr have shown a marked increase in damping below 40 C which is strongly strain amplitude dependent. An interpretation of these results is given in terms of the motion of anti-ferromagnetic domains assumed to exist below 40 C. ***M. E. de Morton.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 294-299.

9474 Further Studies of GPI Zone Formation in Al-2 At. Pet Cu. From variation in Young's modulus and Vicker's hardness during GPI zone formation in Al-2 at.% Cu the following were observed: 1) the presence of grain boundaries has no perceptible effect on the aging reaction; 2) the modulus change is orientation dependent; 3) the activation energy for zone growth is confirmed to be 11 ± 1 kcal per mole; 4) reaging after reversion is preceded by an incubation time. ***C. Chiou, H. Herman, and M. E. Fine.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 2, Apr. 1960, p. 299-307.

9475 Symposium on Fatigue of Welded Structures. Eleven papers are presented. These deal with structural elements and joints that are fabricated from steels and aluminum alloys by fusion welding. ***R. Weck.*** *British Welding Journal*, v. 7, Mar. 1960, p. 161.

9476 Fatigue Strength of Butt Welds in Mild Steel. Briefly reviews methods used for the determination of the fatigue properties of welded joints, and discusses various factors that influence these properties in mild steel butt welds. Several types of butt weld are considered, mainly transverse, transverse welded from one side, longitudinal, and discontinuous longitudinal. ***R. P. Newman.*** *British Welding Journal*, v. 7, Mar. 1960, p. 169-178.

9477 Fatigue Strength of Fillet Welded Joints in Steel. After comparing the relevant clauses of the current design specifications used in Britain, U.S.A., U.S.S.R., and West Germany with some typical experimental results, the paper goes on to consider the effect of the various factors affecting fatigue performance, with particular reference to experimental work carried out since the war. ***T. R. Gurney.*** *British Welding Journal*, v. 7, Mar. 1960, p. 178-187.

9478 Influence of Weld Details on Fatigue of Welded Beams and Girders. Discusses such details as splices, stiffeners, cover plates, and attachments, all of which can be expected to produce a reduction in the fatigue strength of the basic beam. ***W. H. Munse and J. E. Stallmeyer.*** *British Welding Journal*, v. 7, Mar. 1960, p. 188-200.

9479 Effect of Means Stress on Fatigue Properties of Aluminium Alloy Butt-Welded Joints. Three alloys, NS4½H, NP5/6M, and HP3OWP, both non-heat-treated and heat-treated, have very similar fatigue strengths. With increasing mean stress the range of stress decreases until about 4 tons/sq.in. mean stress, above which the range remains almost constant. In general, minor imperfections in the weld do not reduce the fatigue strength below the lower limit of the scatter band obtained with sound joints, but major imperfections could do so. ***K. W. Gunn and R. McLester.*** *British Welding Journal*, v. 7, Mar. 1960, p. 201-208.

9480 Increasing the Fatigue Strength of Butt-Welded Joints. The fatigue limit under cyclic stress of butt-welded joints depends on the surface of the weld bead and on the surrounding medium. By covering the weld bead with plastic material the surface is given a smoother finish; also a medium is provided capable of increasing the fatigue strength. This method enables the dynamic strengths of butt welds to be improved by 75%. ***Werner Gilde.*** *British Welding Journal*, v. 7, Mar. 1960, p. 208-211.

9481 Metallurgical Aspects of Future Research on Fatigue of Welded Structures. Welded joints form a rather special case in that a notch is effectively present, this notch being located in the heat-affected zone which is, conventionally, of low ductility. An evaluation of possible heat-affected zone structures and of their notched fatigue characteristics is desirable. ***W. D. Biggs.*** *British Welding Journal*, v. 7, Mar. 1960, p. 212-216.

9482 Flexural Fatigue Strength of Butt Welds in N.P. 5/6 Type Aluminium Alloy. By comparison with results for the parent plate in the as-received condition, there is a 50% loss of fatigue strength in the as-welded condition. Removal of the bead raises the welded fatigue strength almost to that of the annealed parent plate. ***J. L. Wood.*** *British Welding Journal*, v. 7, May 1960, p. 365-380.

9483 Distortion in Tool Steels. Causes of distortion, measurement of dimensional changes, calculation of size changes, control of distortion, hardening, cold treating, tempering, and aging are discussed. ***Bernard S. Lement.*** 173 pp. 1959. American Society for Metals, Novelty, Ohio. (TS320 L54d)

9484 Theoretical Aspects of Fracture. A general outline is given of some recent views on fracture in metals. The brittle fracture of steel at low temperatures is attributed to the coalescence of glide dislocations to form microcracks, the growth of which require a stress higher than that for coalescence. The start of a tensile cup-and-cone failure in a ductile metal is discussed in terms of the growth of plastic cavities, generally nucleated at inclusions, and a comparison is made between the processes of shear fracture and adhesion occurring between sliding metallic surfaces. ***A. H. Cottrell.*** Paper from "Fracture", p. 20-53, 1959. John Wiley & Sons, New York. (TA405 In8f)

9485 The Ductile-Cleavage Transition in Alpha-Iron. A criterion for the transition in fracture mode from ductile to cleavage is calculated for fracture at a notch. It is concluded

that the temperature dependence of the transition arises more from the Peierls-Nabarro stress than from the strength of the locking of a dislocation source. ***N. J. Petch.*** Paper from "Fracture", p. 54-67, 1959. John Wiley & Sons, New York. (TA405 In8f)

9486 A Review of the Microstructural Aspects of Cleavage Fracture. ***John R. Low, Jr.*** *Paper from "Fracture"*, p. 68-90, 1959. John Wiley & Sons, New York. (TA405 In8f)

9487 Initiation of Cleavage Microcracks in Polycrystalline Iron and Steel. The results of tensile tests carried out at low temperatures are presented for two steels and a vacuum-melted ferrite in several conditions of grain size. Plastic deformation and twinning associated with the microcracks were studied. These findings, correlated with observations of microcracks, define the role of crack initiation in the over-all fracture process. ***G. T. Hahn, B. L. Averbach, W. S. Owen, and Morris Cohen.*** Paper from "Fracture", p. 91-116, 1959. John Wiley & Sons, New York. (TA405 In8f)

9488 Crack Nucleation in Body-Centered Cubic Metals. Detailed examination of the Cottrell mechanism of crack initiation in body-centered cubic crystals indicates that dissociation of the resultant dislocation is easier than crack formation. Grain boundaries and twin boundaries may provide barriers strong enough to enable crack nucleation to occur. ***A. N. Stroh.*** Paper from "Fracture", p. 117-122, 1959. John Wiley & Sons, New York. (TA405 In8f)

9489 The Mechanism of the Brittle Fracture of Metals. Experiments suggest that fracture initiation is not invariably related to dislocation groups formed on yielding. Calculation on closely spaced groups of like dislocations show that crack formation under stress is possible. ***N. P. Allen.*** Paper from "Fracture", p. 123-146, 1959. John Wiley & Sons, New York. (TA405 In8f)

9490 Brittle Fracture and the Yield-Point Phenomenon. A modified theory of Cottrell locking is further developed and compared with experiment. A simple inversion of the equation relating yield point to testing temperature leads to a condition for brittle fracture which is examined in the light of recent experimental work, particularly on Fe and steel, Mo, and Cr. ***N. Louat and H. L. Wain.*** Paper from "Fracture", p. 161-180, 1959. John Wiley & Sons, New York. (TA405 In8f)

9491 Formation of Slip-Band Cracks in Fatigue. Presents results of alternate bending, constant-deflection fatigue tests on high-purity Cu single crystals. Describes development of slip-band extrusions and cracks. Results demonstrate that slip displacements normal to the surface are prerequisites for the initiation of slip-band cracks. ***W. A. Backofen.*** Paper from "Fracture", p. 435-449, 1959. John Wiley & Sons, New York. (TA405 In8f)

9492 Mechanisms of Intergranular Fracture at Elevated Temperatures. Presents evidence for grain-boundary sliding and summarizes measurements made on bicrystal and polycrystalline specimens; models for sliding at grain boundaries are discussed. Gives evidence of the initiation of intergranular cracks in a variety of metals and alloys. ***R. C. Gifkins.*** Paper from "Fracture", p. 579-627, 1959. John Wiley & Sons, New York. (TA405 In8f)

9493 The Effects of Neutron Irradiation on the Properties of Iron and Steels. The principal mechanisms of radiation damage in non-fissile metals are summarized and the terms used in irradiation experiments defined. Neutron irradiation effects on the mechanical properties of single and polycrystalline pure iron are described and the effects on the properties of ferritic and austenitic steels are detailed. ***D. R. Harries.*** *Iron and Steel Institute, Journal*, v. 194, pt. 3, Mar. 1960, p. 289-304.

9494 The Effect of Mode of Stressing in Fatigue Testing. Fatigue tests were carried out on three different alloy steels, in pulsating, alternating, and fluctuating stress, and it has been found that the results can best be represented on a modified Goodman diagram. ***B. Cina.*** *Iron and Steel Institute, Journal*, v. 194, pt. 3, Mar. 1960, p. 324-336.

9495* Brittleness in Chromium-Manganese-Nickel Steel and Its Reduction by Means of Alloy Additions. The development of temper brittleness in this type of steel is affected by the addition of different elements. The tendency to temper brittleness is decreased by alloying not only with Ti, but with Al, and also with Nb (0.17%), W (0.6-0.7%), and Mo (0.3%). Most effective is the complex alloying with W/Ti or W/V. Of practical interest for the industry are the steels 35 KhGNV, 35 KhGNB, and 35 KhGNVT. (*In Russian.*) Khrupnost' khromomargantsevonikelevoĭ stali i ee snizhenie s pomoshch'iu dopolnitel'nogo ligirovaniia. ***M. P. Braun.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, v. 2, no. 10, Oct. 1959, p. 99-107.

9496* Sudden Deformation in Alloys of the Nickel-Chromium System. An investigation of the deformation of a Ni + 16.6 w/o Cr alloy, and of the relaxation of the stress after deformation at different temperatures between 20 and 650 C revealed a connection between the capacity of the alloy for this relaxation and the form of the sudden plastic deformation. A possible mechanism of the sudden deformation of the alloy is suggested. (*In Russian.*) Skachkoobraznaia deformatsiia v splavakh sistemy nikel'khrom. ***L. E. Popov and N. A. Aleksandrov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika*, 1960, no. 1, p. 16-22.

9497* Wear of Aluminum-Magnesium-Zinc Alloys in the Flow of Abrasive Particles at High Temperatures. The abrasive wear in a current of moving corundum particles of Al-Mg and Al-Zn alloys was studied in an air medium at different temperatures between 20 and 400 C. Deformation of the alloys, depending upon the presence of atoms of the alloying element at low temperatures, caused an increase in wear resistance. At high temperatures, wear increases usually in proportion to the amount of alloying element in the alloys. (*In Russian.*) Iznos splavov aliuminiĭ-magniĭ a aliuminiĭ-tsink v potoke abrazivnykh chastits pri povyshennykh temperaturakh. ***V. N. Kashcheev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika*, 1960, no. 1, p. 38-45.

9498 Ageing and Hot Hardness Characteristics of Certain Thorium Alloys. Agin_ experiments at 500, 600, and 700 C on thorium-rich thorium-aluminum and thorium-uranium alloys are described. Al additions improved the hot hardness of Th, and the alloys showed considerable hardening due to precipitation of Th_2Al. Additions of Al and U in excess of the solubility limit restrict the grain growth of Th at 1150 and 1200 C respectively. ***G. H. Baunister, R. C. Burnett, and J. R. Murray.*** *Journal of Nuclear Materials*, v. 2, no. 1, Mar. 1960, p. 51-61.

9499* Deformation of a Duplex Titanium Alloy. ***J. Suiter.*** *Journal of the Less-Common Metals*, v. 1, no. 6, Dec. 1959, p. 476-479.

9500* Materials Below −100 F. Properties of Cu, Al, austenitic stainless steels, Fe and steel, low-alloy steel, nickel-steel alloys, cast iron, piping flexibility, solders, Al to stainless-joints are discussed. ***O. A. Hansen.*** *Mechanical Engineering*, v. 32, Apr. 1960, p. 60-62.

9501* Magnetic Aging of Soft Steel. Low C electrotechnical steel has a tendency to magnetic aging due to high gas saturation. Decreasing the annealing temperature from 920 to 850 C decreases this tendency, which is sharply lowered by refining annealing in H. Increasing the Al content to 0.010 - 0.015% with a N content up to 0.015% and an O content up to 0.006% eliminates the tendency. Aluminum additions, however, make it difficult to obtain low values of the coercive force. (*In Russian.*) Magnitnoe starenie miagkoĭ stali. ***N. P. Zhetvin, L. N. Podvoiskiĭ, A. I. Paisov, and E. P. Kapustina.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 4, Apr., p. 15-19.

9502* Chromium Steels Remain Tough After Eight Years at High Temperature. Results of an unprecedented series of long-exposure tests in operating equipment at 715 and 900 F verify generally the conclusions reached 25 years ago from corrosion and stress-corrosion tests in the laboratory, and from a 15 months' run in petroleum equipment. ***Merrill A. Scheil.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 104-112.

9503* New Iron-Base High-Temperature Alloy? Hot hardness curves for iron alloys containing 20% Cr with Ni, Nb, and C suggest excellent high-temperature strength and suggest the potential of these alloys for elevated-temperature applications. ***G. K. Manning.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 117-119.

9504* Stresses in High-Temperature Corrosive Environments. Tests and service data indicate that clad steels are good

materials for refinery construction. ***William H. Funk.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 71-75.

9505* Hot Working of Plain Carbon Steels. Factors Influencing Working Characteristics. The influence of residual Cu, Sn and Ni, furnace atmosphere and forging temperature on hot workability was investigated by a hot-bend test at 1060 and 1180 C after soaking for six hours at 1150 C in a neutral atmosphere (80% N_2, 10% CO_2, 10% H_2O) with additions of 4% free O_2 and/or 0.1% SO_2. Surface cracking was greater at 1060 C than at 1180 C. ***R. Rolls and A. Preece.*** *Metal Treatment and Drop Forging*, v. 27, Apr. 1960, p. 139-147.

9506* Studies on Austenitic Heat-Resisting Steel. Haynes Stellite 88 was used as base steel and the effect of addition of Co and Nb on age hardness and creep rupture strength was studied. The effect of co-existence of Al and increment of Ni and Co was also examined. ***Yoshikichi Konishi, Takeshi Akutagawa, Toshio Fujita, Ryuichi Nakagawa, and Yasuo Otoguro.*** *National Research Institute for Metals, Transactions*, v. 1, no. 2, 1959, p. 100-106.

9507 Fatigue Deformation in the Interior of Aged Ternary Aluminium-Magnesium-Zinc Alloys. Metallographic observations were made of deformation associated with the fatigue process. It was found that the deformation occurring in these relatively complex alloys differs from that observed in pure metals. ***I. J. Polmear and I. F. Bainbridge.*** *Philosophical Magazine*, v. 4, ser. 8, Dec. 1959, p. 1293-1304.

9508 The Ductile-Brittle Transition in Ionic Solids. Polished monocrystals of AgCl, NaCl, LiF, and MgO were shown to exhibit ductility transitions when loaded by impact bending. It is emphasized that the ductility of ionic solids is extremely sensitive to strain rate and the presence of a notch. ***T. L. Johnston, R. J. Stokes, and C. H. Li.*** *Philosophical Magazine*, v. 4, ser. 8, Dec. 1959, p. 1316-1324.

9509 Measurements of the High-Temperature Electrical Resistance of Aluminum: Resistivity of Lattice Vacancies. The electrical resistance of a 99.995% Al wire was measured at temperatures from 14 to 655 C. Values of temperature coefficient of resistance and of resistivity are derived; they differ somewhat from earlier work. The resistivity values show a progressive increase above the expected values at high temperatures. ***R. O. Simmons and R. W. Balluffi.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 62-68.

9510 Low-Temperature Magnetic Remanence, Molecular Field, and Approach to Saturation of Holmium Metal. Magnetization approaching absolute magnetic saturation has been achieved for polycrystalline Ho metal. At 1.3 K and 70,000 gauss, the magnetic moment is approaching 4.0 Bohr magnetons per atom of Ho in contrast to the 10 Bohr magnetons per atom expected on the basis of the spectroscopically determined quantum numbers. The actual results are explained on the basis of crystalline electric field splitting of the ground term of Ho and application of the Pauli exclusion principle. ***Warren E. Henry.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 89-92.

9511 Temperature Dependence of the Magnetization of Dysprosium Metal. The temperature dependence of the saturation magnetic moment of Dy metal shows a marked departure from the Bloch $T^{\frac{3}{2}}$ law at low temperatures is interpreted as due to magnetic anisotropy. The calculation is in the spin-wave approximation and gives a result which agrees well with the observed temperature dependence of the magnetization if the magnitude of the magnetic anisotropy is suitably chosen. A discussion on the atomic origin of the magnetic anisotropy is given. ***Kazuo Niira.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 129-133.

9512 Thermoelectric Effects in Copper-Gold Alloys. Measurements of the resistivity and thermoelectric power of the binary alloy CuAu and of Cu-Au alloys containing dilute amounts of Ni are analyzed using the thermoelectric power formula of Mott. At the transition temperature, anomalies in the thermoelectric power are observed. The scattering cross section and its derivative with respect to energy for Ni in CuAu are determined. The results are similar in value to these same parameters measured for dilute amounts of Ni in Cu. ***M. D. Blue.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 134-138.

9513 Magnetic Coupling in Crystalline Compounds. A Phenomenological Theory of Magnetism in 3*d* Metals. It is shown that the antiferromagnetic and ferromagnetic structure properties of many crystalline compounds can be qualitatively accounted for on the basis of indirect coupling processes which depend on the overlap of magnetic cation *d* orbitals with *p* orbitals of intervening anions and on the electron spin occupation appropriate to the particular cations involved. ***E. O. Wollan.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 387-401.

9514 Magnetic-Field Dependence of the Ultrasonic Attenuation in Metals. A self-consistent, semiclassical treatment is given for the attenuation of a sound wave by a free-electron gas in a positive background which supports the sound wave. Applications of the general formalism include propagation parallel and perpendicular to the magnetic field. The special phenomena studied include geometric resonances, cyclotron resonances, and magneto-plasma resonance. ***Morrel H. Cohen, Michael J. Harrison, and Walter A. Harrison.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 937-952.

9515 Electrical Resistivity of Europium and Ytterbium. Europium exhibits a sharp peak in its resistivity at 90 K which must correspond to its magnetic ordering temperature. The shape of the peak indicates antiferromagnetic ordering below 90 K. Ytterbium has no sharp anomalies in its resistivity. ***M. A. Curry, S. Legvold, and F. H. Spedding.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 953-954.

9516 Threshold Measurements and the Production of Radiation Damage in the Noble Metals. It is inferred that the threshold energy T_d for radiation damage production in Cu, Ag, and Au is 22, 30, and 40 ev, respectively. The fact that the T_d values are not the same for this homologous series of metals requires reconsideration of the comparison of deuteron radiation damage theory and experiment. ***J. W. Corbett and R. M. Walker.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 970-971.

9517 Electrical Resistivity of Dysprosium Single Crystals. The two magnetic transitions at 90 K and 175 K are very evident in the resistivity. Significant anisotropy is observed only above 175 K, which is the paramagnetic range. ***P. M. Hall, S. Legvold, and F. H. Spedding.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 971-973.

9518 Thermoelectricity and Resistivity in Metal Alloys at Low Temperatures. A simple model is proposed for the "resonant scattering" of electrons from foreign atoms in a crystal lattice. The model assumes the existence of highly selective scattering mechanisms characterized by widths of the order of 10^{-4} e.v. and larger; in this sense, it is similar to the model of Korringa and Gerritsen. ***C. A. Domenicali.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 984-992.

9519 Photoelectromagnetic Effect in Bismuth. The PEM effect has been observed for the first time in Bi. Evaporated Bi films, as well as bulk material, are shown to exhibit the effect. The dependence on the wavelength of the incident light and on the intensity of magnetic field are investigated. ***Thomas Young.*** *Physical Review*, v. 117, 2nd ser., no. 3, Mar. 1, 1960, p. 1244.

9520 Nonlocal Current-Field Relationship in Metals. It is found that Chambers' formula for the response of the conduction electrons of a metal to an internal transverse electric field must be supplemented by a diffusion current when it is used for longitudinal fields. A new derivation of Chambers' formula is given by means of the Boltzmann transport equation, and the additional diffusion term in the current is exhibited explicitly. ***John L. Warren and Richard A. Ferrell.*** *Physical Review*, v. 117, 2nd ser., no. 3, Mar. 1, 1960, p. 1252-1256.

9521 A Note on the Resistivity of Liquid Alkali and Noble Metals. Resistivity values, and some absolute thermoelectric powers, for pure metals and semiconductors at and above the melting point are collected and tabulated. Theories of the change in resistance on melting are discussed in relation to the subdivision of the melting entropy into vibrational and structural parts. ***N. Cusack and J. E. Enderby.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 395-401.

9522* A New Test Method for Determining the Yield Point of Steel. To the surface of a previously drilled specimen is applied a hard ball, the diameter of which is twice that of the

hole. The so-called indentation hardness is obtained in the same manner as the Brinell method—from the compressive load and the area of indentation. From this the yield point of steel can be calculated. (*In German.*) Ein neues Prüfverfahren zur Bestimmung der Streckgrenze von Stahl. ***Karel Waitzmann.*** *VDI Zeitschrift*, v. 102, no. 13, May 1960, p. 528.

9523 Erosion of Surfaces by Solid Particles. The amount of surface material eroded by solid particles in a fluid stream depends on the conditions of fluid flow and on the mechanism of material removal. For ductile materials it is possible to predict the manner in which material removal varies with the direction and velocity of the eroding particles. ***Iain Finnie.*** *Wear*, v. 3, no. 2, Mar.-Apr. 1960, p. 87-103.

See also: **9582** (mechanical properties of low-C steels).

METALS—MECHANICAL WORKING

9524* Effects of the Carbon Content and of the Test Temperature on Strain Hardening and Electric Resistance in Ferritic and Austenitic Steels During Cold Forming. Strain hardening in ferritic steels depends definitely on the form of C precipitation and especially of carbide precipitation inside the grains in the case of low C contents. Carbon contents resulting in perlite formation increase the up-trend of the strain hardening curve. In austenitic steels, the same dependence is represented by a rectilinear curve, the influencing C being in solution in the cubic face-centered lattice. (*In German.*) Einfluss des Kohlenstoffgehaltes und der Versuchstemperatur auf die Verfestigung und den spezifischen elektrischen Widerstand ferritischer und austenitischer Stähle während einer Kaltverformung. ***Eugen Schmidtmann, Ulrich Kalla, and Helmut Brandis.*** *Archiv für das Eisenhüttenwesen*, v. 31, no. 5, May 1960, p. 299-308.

9525 New Metal Working Plant Features Argon-Pressurized Pure Atmosphere. A metal fabrication plant, enclosed in a larger structure, is filled with inert Ar gas to work on such metals as Mo, W, Cb, and Ta. The handling of Ar and safety measures are described. *Heating, Piping & Air Conditioning*, v. 32, May 1960, p. 114-116.

9526 The Causes of Gage Variations in Hot Strip Mills and Their Correction. One of the main causes of gage variation in hot strip mills is the differential between finishing speed of the last roughing stand and entry speed of the first finisher which results in temperature variations along the length of the coil. Variations in applied strip tension also give product variations. By operating the mill with raised looper rollers and a constant small interstand tension the strip can be rolled without rapid gage changes at each end but with a small steady increase in gage from the front to back. Taking into account these characteristics, an attempt is made to define conditions under which an automatic gage control will produce optimum results. ***R. B. Sims.*** *Iron and Steel Engineer*, v. 37, May 1960, p. 69-83.

9527 Plate Mill Furnaces. Features and operating characteristics of the different types of furnaces generally used in plate mills are described and illustrated in the present paper, which has been collated from information and data supplied by several members of the Society of Furnace Builders. Contributions from different sources on furnaces of a particular type are presented. *Iron and Steel Institute, Journal*, v. 194, pt. 3, Mar. 1960, p. 365-383.

9528 Some Aspects of Steel Extrusion. Describes the steel extrusion plant at Low Moor and shows that the process is now firmly established. Some production techniques and extrusion problem are examined. The choice of suitable forms of raw material and the advantages from the low frequency induction method of billet heating are discussed. ***R. Cox, T. McHugh, and F. A. Kirk.*** *Iron and Steel Institute, Journal*, v. 194, pt. 4, Apr. 1960, p. 423-434.

9529* X-Ray Investigation of the Surface Layer of Hardened Steel 45 After Grinding. During grinding some hardened and some softened layers appeared at a different distance from the surface of the specimen. The depth of the hardened layers, the dimensions of the grains, the values of the microstresses, and the amount of dislocations of the crystal lattice depend fundamentally on the amount of feed during grinding. (*In Russian.*) Rentgenovskoe issledovanie poverkhnostnogo sloia zakalennoĭ stali 45 posle shlifovaniia. ***L. I. Mirkin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ Mashinostroenie*, 1959, no. 6, p. 158-161.

9530* The Rolling of Rods, Bars, and Light Sections. Pass design and calculation, mill equipment and product quality, factors influencing yield, rod-mill layout, bar and light-section mills, and combination mills are discussed. ***R. Stewartson.*** *Metallurgical Reviews*, v. 4, no. 16, 1959, p. 309-379 + 5 plates.

9531* Fabrication of a Zircaloy-2 In-Pile Pressure Tube. Successful fabrication of Zircaloy-2 into a critical reactor component demonstrates that with special attention it can be formed into shapes by conventional methods despite its undesirable working characteristics. ***J. G. Goodwin.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 93-96.

9532* Simultaneous Hot Forming and Age Hardening of Titanium Parts. Parts made from Ti alloys of the alpha-beta type can be formed and age hardened at the same time by shaping at a high temperature and holding at that temperature for a short period. ***R. E. Johnson and R. J. McClintick.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 130-132.

9533* Precision Forging Up To Date. Discusses some of the difficulties that forgers have met and solved in research and in regular production to produce close-tolerance parts. *Metal Progress*, v. 77, no. 5, May 1960, p. 125-131.

9534* Practical Aspects of Cavity Sinking. Discusses production of die cavities by spark-machining method. Compares the relative advantages of various methods of electrode manufacture and materials, methods of setting and clamping, and erosion sequence. ***G. H. C. Rhodes.*** *Metal Treatment and Drop Forging*, v. 27, Apr. 1960, p. 151 + 10 pages.

9535* Tool Wear When Cutting Thin Sheet Material. Cutting tools are subject to front-face and cylindrical-surface wear produced by a sliding action of the workpiece material under pressure. When cutting thin sheet material, front-face wear predominates. For determining the possibility of cutting of sheet material, wear- and burr-formation curves are essential. ***H. J. Crasemann.*** *Microtecnic* (English Edition), v. 14, no. 1, Feb. 1960, p. 25-29.

9536* Effects of Clearance and Rake Angles on Tool Life. ***E. Bodart and G. Andri.*** *Microtecnic* (English Edition), v. 14, no. 1, Feb. 1960, p. 30-33.

9537* Precision Cold Extrusion of Metals. The process, which offers rapid production of parts with close dimensional control, has been used successfully to fabricate steel, Al, Ti, and some of the uncommon metals. ***R. A. Quadt.*** *Metal Progress*, v. 77, no. 5, May 1960, p. 121 + 4 pages.

9538* Experience in Surfacing Steel Rolls of Blooming-Slabbing Mill Trains by Powder Welding Process. Restoration of the former dimensions and improvement of durability; dimensions and weight of the rolls; selection of welding materials; machining and heat-treating before and after welding. (*In German.*) Betriebserfahrungen über das Aufschweissen von Stahlwalzen für Block-Brammen-Strassen im Unterpulver-Schweissverfahren. ***Hans Stoll.*** *Stahl und Eisen*, v. 80, no. 8, Apr. 14, 1960, p. 483-491.

9539* Effect of the Nozzle Shape on the Rate of Flame Cutting. A nozzle with a profiled extension was developed for straight cutting. By increasing the working pressure, the nozzle provides for maximum cutting rates to be obtained without impairing the finished quality. Metallographic tests showed that the undesirable formation of martensite on the cutting edge can be reduced by selecting a nozzle of suitable shape. (*In German.*) Der Einfluss der Düsenform auf die Schnittgeschwindigkeit beim Brennschneiden. ***Alexander Matting and Kamalesh Roy Choudhury.*** *VDI Zeitschrift*, v. 102, no. 12, Apr. 21, 1960, p. 459-466.

See also: **9381** (molybdenum extrusion dies); **9505** (hot working of carbon steels).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

9540 The Application of the Rowland Mechanism to the Problem of the Nucleation of the Secondary Crystals in Cube-Texture Copper. Experimental evidence is provided that the growth of large secondary crystals with the Kronberg and Wilson orientations is preceded by the formation of crystals with the orientation $\{111\}\ <112>$ during the secondary recrystallization of heavily twinned cube-texture Cu. The nucleation of the $\{111\}\ <112>$-crystals is explained with the aid of the Rowland lattice model. ***C. A. Verbraak.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 65-70.

9541 Isothermal Reversion of the B.C.C.→H.C.P. Transformation Induced in β' AgCd by Mechanical Deformation. The hexagonal close-packed structure induced in β' AgCd by mechanical deformation was found to revert gradually to the original body-centered cubic structure at room temperature. The rate of reversion was measured for several alloys of composition around 50 at.%. The reversion rate was found to be dependent on composition and temperature. ***D. B. Masson.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 71-80.

9542 The Cobalt Transformation. When the h.c.p. phase is generated from the f.c.c. phase by cooling through the allotropic transformation range, two types of faulted regions become evident: region one contains only deformation faults, and region two contains both deformation and growth faults. It is suggested that region one constitutes the first part of the h.c.p. phase to form on cooling, while region two represents the latter part of the transformation. ***C. R. Houska, B. L. Averbach, and M. Cohen.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 81-87.

9543 Subcrystals in Large Vapour-Grown Crystals of Tungsten. A substructure has been found in W crystals. The disorientation between the subcrystals is at random and is therefore different from that found in single crystals in recrystallized doped W wires. The occurrence of a substructure or even dendritic branches depends upon the circumstances during the growth. ***G. D. Rieck and H. A. C. M. Bruning.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 97-105.

9544 Polygonization of 31% Alpha-Brass. Single crystals bent within, as well as slightly beyond, the single slip region were polygonized to form dislocation walls after a final anneal of 1-2 hr at 700 C or 750 C. Bent polycrystalline specimens having very high dislocation densities in all sets of active slip planes were polygonized to form subgrain boundaries after a similar anneal. ***V. Y. Doo.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 106-111.

9545 Diffusion of Antimony in Copper Single Crystals. The rate of diffusion of Sb in Cu single crystals was measured over the temperature range 600-1000 C by means of a sectioning technique employing the Sb^{124} radio-isotope as tracer. The diffusion activation energy and frequency factor were found to be 42000 ± 700 cal $mole^{-1}$ and 0.34 ± 0.12 cm^2 sec^{-1}. ***M. C. Inman and L. W. Barr.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 112-116.

9546 Oxide Nuclei and Dislocations. There was a correlation between oxide nuclei and dislocations in Cu doped with Te or Sn and in OFHC copper. Oxide nuclei were not formed at dislocations in 99.999 per cent Cu or in Cu doped with Si. ***F. W. Young, Jr.*** *Acta Metallurgica,* v. 8, Feb. 1960, p. 117-123.

9547 The Crystallography of the Austenite-Martensite Transformation. The $\{111\}$ Shear Solutions. The graphical method is applied to the austenite-martensite transformation. The undistorted planes are determined for the lattice invariant shear on the (111) austenite plane. The solutions are discussed in terms of their degeneracy and their applicability to the formation of (225) martensite in steel. ***M. S. Wechsler, T. A. Read, and D. S. Lieberman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 202-207.

9548 The Composition Range of Ti_2Co. The intermetallic compound Ti_2Co was studied by X-ray diffraction and metallographic techniques. The phase occurs off stoichiometric composition, with its greatest variance at high temperature. The solubility limits were determined and an amendment to the Ti-Co phase diagram is suggested. ***G. R. Purdy and J. Gordon Parr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 225-227.

9549 Determining Boron Distribution in Metals by Neutron Activation. The autoradiographic method for measuring B distribution in metals was demonstrated to be a valuable addition to standard metallographic techniques. The maximum permissible neutron exposure is about 1×10^{12} nvt. With this neutron dose, B-rich areas have been observed at concentrations of 0.0006% B. ***Barbara A. Thompson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 228-231.

9550 Solid Solution and Second-Phase Strengthening of Nickel Alloys at High and Low Temperatures. Five or six alloys each in the systems Ni-Cr, Ni-Mo and Ni-W, spaced to cover the single-phase areas as well as a part of the adjacent two-phase field, were prepared as vacuum-melted alloys. Tensile tests at room temperature and stress rupture tests at 1200 and 1500 F were run for time periods to give fracture in 0.1 to 500 hr. ***Regis M. N. Pelloux and Nicholas J. Grant.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 232-237.

9551 Beta Decomposition in Zr-U-O Alloys. The β decomposition of Zr-U-O alloys was studied during an interrupted quench from the $\alpha + \beta$ region. Decomposition was more rapid than in binary Zr-U alloys of the same U content or of equivalent β composition. ***D. L. Douglass.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 237-242.

9552 Effect of Carbide Dispersion in Molybdenum Alloys. The phase identification results on several Mo-base alloys are presented. These results have been correlated with strength data and microstructural studies to indicate that carbide dispersion may raise the recrystallization temperature and strength of Mo alloys. ***W. H. Chang.*** *American Institute of Mining, Metallurgical and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 254-256.

9553 Permeability and Diffusion of Hydrogen Through Palladium. Palladium has a large capacity for the dissolution or occlusion of hydrogen; the gas also diffuses very rapidly through the metal. Palladium thimbles are widely used in the laboratory for purification of hydrogen by diffusion. ***M. van Swaay and C. E. Birchenall.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 285-289.

9554 Stress Induced Strain Aging. Experiments have been carried out to study the effect of an applied stress on strain aging in steel. The stress-induced strain aging reaction proceeds rapidly in the temperature range of 0 to 60 C. ***J. O. Brittain and S. E. Bronisz.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 289-294.

9555 The Self-Diffusion of Columbium. The self-diffusion coefficient of Cb has been measured over the temperature range 1535 to 2120 C, using the radioactive isotope Nb^{95} as the tracer. The data for the temperature dependence of the self-diffusion coefficient are best fitted by the equation $D = (12.4 \pm 0.8) \exp[(-105{,}000 \pm 3000)/RT] cm^2/sec$. ***R. Resnick and L. S. Castleman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 307-310.

9556 Carbide Precipitation and Evolution and Depletion of Matrix in Heat Resisting Steels and Alloys Treated in Carburizing Atmospheres. Heat-resisting chromium steels and alloys treated at 825 or 950 C in a carburizing atmosphere exhibit an extensive carbide precipitation. This carbide precipitation may be succeeded by the FeCr σ phase or by a carbide with a higher C content. ***G. Pomey.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 310-314.

9557 Stabilization of Certain Ti_2Ni-Type Phases by Oxygen. In the systems Ti-Mn-O, Ti-Fe-O, Ti-Co-O, and Ti-Ni-O the boundaries of the Ti_2Ni-type phases were determined at one or more temperatures and the variation of the lattice parameter with O_2 content was determined. The results indicate that the occurrence of the phase in these systems can be correlated qualitatively with valency electron concentration, and that the role of O_2 is that of an electron acceptor. ***M. V. Nevitt.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 327-331.

9558 Transformation Mechanisms in a Hypereutectoid Titanium-Chromium Alloy. A detailed morphological study was made of the proeutectoid $TiCr_2$ and the eutectoid reactions in a Ti-17.42 pct Cr alloy isothermally transformed at temperatures from 775 through 550 C. The morphologies of proeutectoid $TiCr_2$ were found to be subject to description by the Dubé morphological classification system. ***H. I. Aaronson, W. B. Triplett, and G. M. Andes.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 331-339.

9559 An X-Ray Reflection Micrographic Method for Measuring Subgrain Boundary Angle. A method for determining the disorientation between subgrains that share a common tilt or twist boundary from measurements on X-ray micrographs is described. The method may be applied to subgrains of almost any orientation. ***R. J. Towner and J. Alfred Berger.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 339-342 .

9560 On the Imperfections in Martensite and Their Relation to the Formation of Martensite. Certain choices for the shear elements of the inhomogeneous distortion in the phenomenological theory of martensite formation are examined for their agreement with crystallographic and X-ray data of iron alloys. The assumption that the shear elements must represent slip or twinning systems characteristic of bcc metals is found to cover all observations. ***Henry M. Otte.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 342-351.

9561 Critical Recrystallization of Zirconium. At temperatures above 950 F, Zr which was strained a critical amount will experience critical recrystallization. The large grain size thus formed can result in a reduction in the fatigue life by a factor of 2 to a factor of 9 at both high and low temperatures. ***J. C. Bokros.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 351-353.

9562 Grain Boundary Grooving by Volume Diffusion. The development, by the mechanism of volume diffusion, of a grain boundary groove on an interface separating a solid phase and a saturated fluid phase is calculated under the following assumptions: 1) isotropy of the interfacial free energy γ_s, 2) applicability of the Gibbs-Thompson formula relating curvature and chemical potential, 3) a nearly planar groove surface. ***W. W. Mullins.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, no. 2, Apr. 1960, p. 354-361.

9563* Light-Scattering by Dislocation Networks in Single Crystals of Potassium Chloride. It was found that the scattering system has fourfold axes of rotation parallel to the $<100>$ directions of the crystal, and a partial Fourier analysis of the scattering power indicates that the scattering is mainly produced by networks of dislocations in the $\{100\}$ planes, the individual lines being mostly directed along the $<100>$ directions of the crystal. ***O. Theimer, C. A. Plint, and W. A. Sibley.*** *Annals of Physics,* v. 9, Apr. 1960, p. 475-498.

9564* Effect of Dissolved Oxygen on Absorption Speed and Solubility of Nitrogen in Molten Iron. The N pick up and speed of saturation of N in Fe with 0.001 to 0.020 and 0.15 to 0.24% O at 1600 C with the N at a pressure of 50-500 mm Hg was investigated. The saturation speed of N in Fe is independent of the O content in the melts. The activity coefficient is expressed by: $\lg f_N = 3.3 \cdot [\%\ N]$, when the infinitely diluted solution is selected as the state of reference for the activity. (*In German.*) Aufnahmegeschwindigkeit und Löslichkeit von Stickstoff in flüssigem Eisen in Abhängigkeit vom gelösten Sauerstoff. ***Wilhelm Anton Fischer and Alfred Hoffman.*** *Archiv für das Eisenhüttenwesen,* v. 31, no. 4, Apr. 1960, p. 215-219.

9565* Investigations of the Recrystallization of an Austenitic Chromium-Nickel Steel With Special Allowance for the Annealing Time. In an austenitic steel with about 18% Cr and 12% Ni, formed between 0 and 70% the structure, hardness and magnetic saturation after 24 hours annealing up to 500 C, and the structure and hardness after annealing from one second to two hours between 500 and 1400 C were examined. There was no secondary recrystallization at high temperatures, marked deformations and long annealing times. (*In German.*) Untersuchungen über die Rekristallisation eines austenitischen Chrom-Nickel-Stahles unter besonderer Berücksichtigung der Glühdauer. ***Heinz Borchers, Karl Bungardt, and Dieter Pusch.*** *Archiv für das Eisenhüttenwesen,* v. 31, no. 4, Apr. 1960, p. 237-242.

9566 Transformation of Graphite Inclusions in Cast Iron Saturated (in Solid State) With Magnesium. The procedure of inoculation of cast iron in solid state with Mg (up to 2%) is described. The sequence of changes from flake to nodular shape of graphite is given. ***F. N. Tavadze and M. A. Essen.*** *Henry Brutcher Translation No.* 4713, 12 pp. (From *Liteinoe Proizvodstvo,* v. 10, no. 6, 1959, p. 15-18.) Henry Brutcher Altadena, Calif.

9567 Peculiarities of Transformations During Rapid Recrystallization of Steel. The results of the investigation show the possibility of introducing a new recrystallization process for cold-reduced steel, which consists of a rapid brief heating to a high temperature and fast cooling. ***F. K. L'vov.*** *Henry Brutcher Translation No.* 4716, 4 pp. (From *Nauchn. Doklady Vyssh. Shkoly - Metallurgiya,* 1959, no. 1, Jan.-Mar., p. 203-205.) Henry Brutcher, Altadena, Calif.

9568 Nature of Carbide Phase in Titanium-Alloyed Steels. Conditions, under which pure titanium carbide is formed in carbon steel, were investigated. The nature of titanium oxide and titanium carbosulfide inclusions was examined. ***Yu. T. Lukashevich-Duvanova and V. A. Urazova.*** *Henry Brutcher Translation No.* 4785, 10 pp. (From *Izv. Akad. Nauk, Otd. Tekh. Nauk, Met. i Toplivo,* 1959, no. 5, Oct., p. 127-130.) Henry Brutcher, Altadena, Calif.

9569* On the Diffusion of Silver in Copper Protoxide. Investigation gives the results of an experimental study of the diffusion of silver into mono- and polycrystals of copper protoxide. The investigation of the diffusion was carried out by the method of marked atoms, using the Ag^{110} isotope. The investigation shows the exponential change of the diffusion coefficient dependent on the temperature; cited are values of the coefficients of diffusion into copper protoxide of different structure. (*In Russian.*) O diffuzii serebra v zakis' medi. ***A. I. Andrievsky, A. V. Sandulova, and M. I. Yurkevich.*** *Fizika Tverdogo Tela,* v. 2, no. 4, Apr. 1960, p. 624-628.

9570 The Solubility of Carbon in Molten Iron-Nickel Alloys. The solubility of graphite in iron-nickel alloys was redetermined at 1350 C. Deviations from ideal behavior are found and these are interpreted to indicate a negative heat of mixing in liquid iron-nickel alloys having a maximum value of 75 at.% Ni. ***R. G. Ward and J. A. Wright.*** *Iron and Steel Institute, Journal,* v. 194, pt. 3, Mar. 1960, p. 304-306.

9571 Diffusion and Solubility of Sulphur in Iron and Silicon-Iron Alloys. The behavior of S in the Fe-rich portion of the Fe-Si-Mn-S system was studied. The volume diffusion coefficient of S in pure Fe and 3.25% Si-Fe was measured as a function of temperature. ***Norman G. Ainslie and Alan U. Seybolt.*** *Iron and Steel Institute, Journal,* v. 194, pt. 3, Mar. 1960, p. 341-350.

9572* Determination of the Solubility of Chromium Oxide in Ferrous Slags. By the method of the electromotive forces, a study was made of the effect of ferric oxide additions (up to 30%) on the solubility of chromium oxides in molten slag with the following initial composition: 50% CaO, 35% SiO_2, 8% Al_2O_3 and 7% MgO. It was shown that the formulas of the theory of the regular ion solution with corrections for the polymerization of silica well describe the experimental materials and can be used for approximative calculations of the solubility of Cr_2O_3 in

molten slags. (*In Russian.*) Opredelenie rastvorimosti okislov khroma v zhelezistykh shlakakh. ***O. A. Esin and I. N. Zakharov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia*, v. 2, no. 10, Oct. 1959, p. 9-16.

9573* Effects of High Hydrostatic Pressure on the Transformation of Martensite Into Austenite in an Iron Nickel Alloy. An apparatus to give high hydrostatic pressures was designed and a method developed permitting the direct observation, during application of pressure, of the transformation of martensite into austenite between 120 and 500 C. In the alloy tested, the initial temperature of the martensite transformation shifted 25 C for each 1000 kg/cm^2 of pressure. (*In Russian.*) Vliianie vysokogo gidrostaticheskogo davleniia na prevrashchenie martensita v austenit v zhelezonikelevom splave. ***N. A. Smirnov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia*, v. 2, no. 10, Oct. 1959, p. 109-112.

9574 The Transformation Temperatures of High-Purity Uranium. The solid state transformation temperatures and the logarithm of the heating or cooling rates are related linearly. The extrapolated functions intersect at the equilibrium temperature. ***Bernhard Blumenthal.*** *Journal of Nuclear Materials*, v. 2, no. 1, Mar. 1960, p. 23-30.

9575 The Diffusion and Solubility of Hydrogen in the Alpha-Phase of Zircaloy-2. The diffusion of H in the α-phase of zircaloy-2 was measured in the temperature range 260 to 560 C using the gradient technique. The diffusion coefficient was found to be $D = 2.17 \times 10^{-3} \exp(-8380/RT)$ cm^2/sec. ***A. Sawatzky.*** *Journal of Nuclear Materials*, v. 2, no. 1, Mar. 1960, p. 62-68.

9576 The Uranium-Molybdenum Equilibrium Diagram Below 900°C. The U-Mo equilibrium diagram was determined up to 19 wt% Mo and below 900 C. The eutectoid transformation $\beta \rightleftharpoons \alpha + \gamma$ was located at 639 ± 5 C. The limit of the $\beta + \gamma$ field was placed at 4.5 wt% Mo at the eutectoid temperature. ***Austin E. Dwight.*** *Journal of Nuclear Materials*, v. 2, no. 1, Mar. 1960, p. 81-87.

9577 The Nature of Subgrain Boundaries Due to Phase Transformation in Uranium. The results of these experiments confirm the hypothesis that subgrains in $\beta \rightarrow \alpha$ transformed U are due to a strain-induced form of polygonization of glissile dislocations in the α-U lattice. ***R. W. Cahn and H. Tomlinson.*** *Journal of Nuclear Materials*, v. 2, no. 1, Mar. 1960, p. 88-89.

9578* Research on Alloys of Noble Metals With More Electropositive Elements. II. Micrographic and Roentgenographic Examination of Magnesium-Palladium Alloys. Preparation and general properties of the alloys, chemical analysis, specific gravity determination, micrographic and X-ray examination are described. A table of Magnesium-Palladium alloy properties and microphotographs are cited. ***Riccardo Ferro.*** *Journal of the Less-Common Metals*, v. 1, no. 6, Dec. 1959, p. 424-438.

9579* An Investigation of the Neptunium-Uranium Equilibrium Diagram. General form of the Np-U diagram was determined by thermal analysis, dilatometry and X-ray techniques, using a very limited amount of Np. The results indicate high solubility of U in the α and β phases of Np and of Np in the α and β phases of U; the room-temperature solubility of Np in α-U has the unusually high value of 43 wt-%. ***P. G. Mardon and J. H. Pearce.*** *Journal of the Less-Common Metals*, v. 1, no. 6, Dec. 1959, p. 467-475.

9580* The Niobium-Rhenium System. The constitutional diagram of the Nb-Re system was determined for the entire range of compositions. Two intermediate phases occur, one with sigma structure (σ), the other with an α-Mn type (χ). The sigma phase is formed peritectically at 57 at-% Re and exists over only a small range of compositions and temperatures. ***A. G. Knapton.*** *Journal of the Less-Common Metals*, v. 1, no. 6, Dec. 1959, p. 480-486.

9581* The Earliest Days of Precipitation Hardening. During a European tour last year, an American pioneer in the field uncovered little-known facts about the invention of the art of age hardening and the discovery of the scientific principles of precipitation hardening. ***W. A. Mudge.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 79-82.

9582* Application of Electron Microscopy. Three types of low-C steel were heat treated and the mechanical properties compared with those obtained after normalizing. The structures were examined both by optical and electron microscopes. ***Sten Modin.*** *Metal Treatment and Drop Forging*, v. 27, Apr. 1960, p. 133-138.

9583 Diffusion and Desorption of Metal Impurities in Platinum. Activation energies for the volume diffusion of certain impurities in polycrystalline Pt samples were obtained by studying the ions released from their surfaces at temperatures above 1000 C. For one Pt sample these energies were 4.7 ± 0.2 ev for the diffusion of Na, 4.4 ± 0.2 ev for K, and 3.7 ± 0.2 ev for Ca. For a second sample, however, all the energies were 10-15% higher. ***Richard C. Bradley.*** *Physical Review*, v. 117, 2nd ser., no. 5, Mar. 1, 1960, p. 1204-1207.

9584 Studies Relating to Hydrogen in Dingot Uranium. Solubilities and effects of H were determined on Mg, U, and magnesium fluoride slag. The possibility of removing H from U by degassing at elevated temperatures and at low pressures was considered. Calculations were made for the diffusion of H in U rod. Several cases were chosen to illustrate the potentialities of this technique. ***Max J. Trzeciak and Manley W. Mallett.*** *U. S. Atomic Energy Commission, BMI-1225*, Sept. 20, 1957, 32 pp. (UF767 U3b Contin.)

See also: **9023** (structure of electrodeposited Cu); **9027** (structure of electrodeposited Cu); **9486** (microstructural aspects of cleavage fracture); **9529** (structure of ground steel surfaces).

METALS—POWDER

9585* Effects of Oxygen Content on Some Properties of Iron and Copper Powder. Oxygen has a definite influence on the process of sintering, in the form of an oxide coating as well as added O. The effect of O depends on the sintering time. With lower O contents, the time to obtain the same properties is longer. The effects of oxides introduced into the powder mixture is similar to that of oxide coatings. (*In Polish.*) Wpływ zawartości tlenu na niektóre własnosci proszków żelaza i miedzi. ***Władysław Rutkowski.*** *Hutnik*, v. 27, no. 3, Mar. 1960, p. 105-108.

9586 The Fabrication of Clad Massive UO_2 Fuel Elements by Coextrusion. Promising samples of two potential types of metal-clad UO_2 rods were produced. One contains a stainless clad over an oxide core with an intervening layer of graphite about 15 mils thick. Another has a refractory metal cladding instead of stainless steel and no interlayer; here the Ta used is only indicative of what might be expected with the more desirable metals, Cb and Mo. ***F. S. Gardner and J. G. Hunt.*** *U. S. Atomic Energy Commission, NMI-2505*, Jan. 14, 1960, 35 pp. (UF767 Un3.1nm Contin.)

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

9587 Evaluation of Surface Defects by Nondestructive Testing. The newest testing devices and methods are described. A completely automatic installation for billet inspection is dependent upon successful solution of a number of problems. ***W. A. Black.*** *Blast Furnace and Steel Plant*, v. 48, May 1960, p. 459-466.

9588 Ultrasonic Inspection, One of the Methods of Testing [Heavy-Duty Steel] Castings. Nondestructive tests, among them the ultrasonic test, are applied successfully today to high-grade forgings. Ultrasonic testing, with its precise fault location in combination with radiography, given good welding characteristics of the castings, is of special importance. ***R. Schinn.*** *Henry Brutcher Translation No.* 4787, 9 pp. (From *Giesserei*, v. 46, no. 26, 1959, p. 977-980.) Henry Brutcher, Altadena, Calif.

9589 Detector Car History and New Developments. In locating more successful method the residual magnetic method must be considered. The German Federal Railway has developed and is using an ultrasonic detector car for the detection of all

types of defects. ***H. W. Keevil.*** *Electrical Engineering*, v. 79, Apr. 1960, p. 265.

9590 The Permissible Amounts and Use of Radioactive Cobalt for Detecting Blast-Furnace Lining Wear. An account is given of the use of Co^{60} in the assessment of blast-furnace lining wear, and the potential resultant contamination of steel is evaluated. Details are presented of experimental work on the fogging of fast X-ray film by exposure to steel contaminated with Co^{60}. Recommendations are developed as to desirable upper limits of contamination. Contamination of steel should not be allowed to exceed 20 μc/ton and restricted to a modest percentage of steel output. ***A. Metcalf.*** *Iron and Steel Institute, Journal*, v. 194, pt. 3, Mar. 1960, p. 360-363.

9591* Notes on Ultrasonic Testing. Numerous examples of cracks revealed by ultrasonic control of locomotive axles demonstrate the existence of two types of failures: one fast growing and one much slower, which have quite different characteristics. A simple method is described to calculate the solid angle of an ultrasonic beam going through two media of different density, separated by a cylindrical surface. (*In Italian.*) Note sugli esami ad ultrasuoni. ***S. Cardona.*** *Metallurgia Italiana*, v. 52, Mar. 1960, p. 107 + 12 pages.

9592* New Eddy Current Test for Tubing. Small defects can be readily located in tubes by a new eddy-current testing setup containing circuitry that filters out background interference. ***Byron B. Burd.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 101-103.

9593* Recent Advances in New Areas of Nondestructive Testing. Sketches some of the new standard methods for nondestructive testing, and some of the more recent advances in the other standard methods. ***Herbert A. Elion.*** *Nondestructive Testing*, v. 18, no. 3, May-June, 1960, p. 180-182.

9594* Radiographic Contrast in Double-Film Techniques. In the double-film technique for increasing radiographic speed, two films are exposed simultaneously in the same exposure holder and viewed in register. Single- and double-film techniques will give the same radiographic contrast when the total net density on the double film equals the net density on the single film. ***G. M. Corney.*** *Nondestructive Testing*, v. 18, no. 3, May-June 1960, p. 183-184.

9595* Nondestructive Testing of Steel and Steel Products. Three examples, the seam depth indicator, the Farrow test, and the small ultrasonic tester, indicate how one steel producer has tried to meet its need in nondestructive testing. Specialists in nondestructive testing have naturally concentrated their attention on the high risk applications in which the user can afford elaborate testing in the interests of safety. ***W. A. Black.*** *Nondestructive Testing*, v. 18, no. 3, May-June 1960, p. 185-190.

9596* A Technique for Ultrasonically Testing Large Forgings With Relatively Thin Wall Sections. The forgings were tested by means of shear wave techniques. Sufficient gain is available to permit instrument tuning so that a full screen signal is obtained from any of the reflecting areas used. ***Gilbert E. Ronca.*** *Nondestructive Testing*, v. 18, no. 3, May-June 1960, p. 191-192.

9597 Microwave Thickness Detector. A device is described which is capable of continuously measuring the thickness of moving conducting materials. The details of two independent methods, one utilizing the amplitude and one the phase of reflected microwave energy, are explained and compared. ***James B. Beyer, J. Van Bladel, and Harold A. Peterson.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 313-316.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

9598* Resonance Scattering of γ-Rays of La^{140}. Scattering of La^{140} γ-rays on Ce^{140}. (*In Russian.*) Rezonansnoe rasseianie γ-luchei La^{140}. ***B. S. Dzhelepov and M. A. Dolgoborodova.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 24, no. 3, Mar. 1960, p. 304-310.

9599* Classical Radiation From a Uniformly Accelerated Charge. Contrary to claims in some standard sources (Pauli, von Laue), a charge in uniform acceleration does radiate. The radiation rate is finite, invariant, and constant in time in the instantaneous rest system. ***Thomas Fulton and Fritz Rohrlich.*** *Annals of Physics*, v. 9, Apr. 1960, p. 499-517.

9600* The Many π-Meson Problem. It is shown that the properties of a system of $N\pi$-mesons are to a considerable extent determined by three quantum numbers ($N_1N_2N_3$), the "correlation numbers" whose sum equals N. For states with definite correlation, the correlation numbers dictate which I-spin values such states can possibly have. ***A. Pais.*** *Annals of Physics*, v. 9, Apr. 1960, p. 548-602.

9601* A Numerical Method to Calculate Reactor Cooling Channels in Any Thermal Source Distribution in the Fission Element. If the thermal emission distribution of a fission product element is merely given as the result of measurements in the form of a table or diagram, then it is impossible to calculate the development of the cooling system temperature and that of the surface area of the fission element. In these cases, a procedure is suggested which enables one to estimate numerically the temperature variations with only a few calculations. (*In German.*) Ein numerisches Verfahren zur Berechnung von Reaktorkühlkanälen bei beliebiger Wärmequellenverteilung im Spaltstoffelement. ***W. Strewe.*** *Atmokernenergie*, v. 5, Apr. 1960, p. 134-141.

9602* Asymmetries in the Beta Decay of Polarized Neutrons. The result of the authors is consistent with time reversal invariance in the neutron decay. The measured coincidence asymmetry, after correction for detection geometry, electron energy, and polarization of the neutron beam, gives $B = +0.96 \pm 0.40$. ***M. A. Clark and J. M. Robson.*** *Canadian Journal of Physics*, v. 38, May 1960, p. 693-695.

9603* The Resonant Diffusion of 23.8 KeV γ-Rays of ^{119}Sn Emitted With No Recoil. Photons re-emitted by ^{119}Sn after resonant absorption of photons emitted without recoil by ^{119}Sn were examined. The value of the Debye Waller factor at about 90 K measured by this method agrees well with the value measured by transmission. (*In French.*) Diffusion résonnante du rayonnement γ de 23,8 keV de ^{119}Sn émis sans recul. ***Roland Barloutaud, Jean-Loup Picou, and Christophe Tzara.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 15, Apr. 11, 1960, p. 2705-2707.

9604* Radiative Capture of Thermal Neutrons on Nucleus II. The energies and intensities of gamma rays from the capture of a neutron on Na ,Co, Zn, Ag, Te and I nucleus in the 20-1000 keV energy region were measured with a single-crystal, single-channel scintillation spectrometer. New energies of radiative transition were measured when measuring Co, Zn, Te and I nuclei. (*In Russian.*) Radiatsionnyy zakhvat teplovykh neitronov yadrom II. ***J. Kopecký, J. Kajfosz, and J. Urbanec.*** *Czechoslovak Journal of Physics*, v. 10, no. 2, 1960, p. 119-128.

9605* On the Possibility of the Investigation of Distribution Density of Phonons in a Non-Coherent Scattering of Neutrons. Calculations and discussions are cited. (*In Russian.*) O vozmozhnosti issledovaniia plotnosti raspredeleriia fononov v nekubicheskom kristalle s pomoshch'iu nekogerentnogo rasseianiia neĭtronov. ***V. S. Oskotskiĭ.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 701-703.

9606 The Isotopic Contamination in Electromagnetic Isotope Separators. The mechanisms of contamination are studied with the aid of the above apparatus. After disconnecting the trivial ones, there remain two competing mechanisms: the scattering of the ion beams by the residual molecules or atoms and the instability of the ion sources, the effects of which cannot be corrected simultaneously. By combining the two partial schemes into a single one, we can account for all the facts relating to isotopic contamination. (*In French.*) La contagion isotopique dans les séparateurs électromagnétiques d'isotopes. ***Charles Cassignol.*** *France, Commissariat a l'Énergie Atomique, Rapport CEA No.* 1185, 1959, 58 pp. (QC770 F84.2r Contin.)

9607 On the Integral Neutron Spectrum in a Time-Dependent Problem. The slowing-down equation governing the neutron time-dependent distribution in the case of heavy mass scatterer is solved in an elementary approximate manner. Results are in good agreement with those obtained by use of more rigorous treatments. (*In Italian.*) Sullo spettro neutronico integrale in un problema dipendente dal tempo. ***V. Benzi. Italy,***

Comitato Nazionale per le Ricerche Nucleari, CNC-25, Feb. 1960, 8 pp. (QC770 It1.2c Contin.)

9608* Bonding Energy of a Nucleon and Hyperon System. At small distances there can be no repulsion forces between the hyperons. In this case the systems of the bonded particles can have larger mass defects. A Λ-particle and nucleon system was used in investigating the conditions of stability of such systems when passing in the nucleon state. (*In Russian.*) Ob energii sviazi sistemy nuklonov i giperonov. ***V. A. Filimonov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1960, no. 1, p. 60-63.

9609* A Contribution to the Problem of the Motion of Polarized Electrons in a Magnetic Field. The interaction of polarized electrons with a photon vacuum was studied. By the method of the disturbance theory, it was shown that fluctuations in the vacuum cause periodic passages of an electron from one state of polarization to the other. A quantitative calculation of the effect applicable to particles of arbitrary energy was made. (*In Russian.*) K voprosu o dvizhenii poliarizovannykh elektronov v magnitnom pole. ***I. M. Ternov and V. S. Tumanov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1960, no. 1, p. 155-163.

9610* Power From Gas-Cooled Reactors. In England power is generated in reactors using natural U as fuel. American engineers believe that operating temperatures should be much higher and prefer enriched uranium oxide as fuel. ***E. E. Thum.*** *Metal Progress*, v. 77, no. 4, Apr. 1960, p. 123-126.

9611* Energy Dependent Instrumental Time Delays in Millimicrosecond Delayed Coincidence Experiments. The most important factor was found to be due to the time lag between the excitation of the scintillator and the appearance of the first few photoelectrons used to trigger the coincidence circuit. These time delays are of the order of 10^{-10} sec and may introduce serious systematic errors. It is shown that these errors can be eliminated by making use of an electron-electron coincidence spectrometer. ***Ekbal Bashandy.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 289-295.

9612* Investigation of An Assembly for Measurement of the Components of Nuclea of Cosmic Radiation. A description is given of the Neutron Intensity Monitor on the Schauinsland near Freiburg im Breisgau, Germany. By adding 60 boron-10-detectors to the Standard-Pile-Geometry designed by Simpson *et al.* it was possible to reduce the statistical error from 0.46 to 0.29% for the hourly mean. The medium rigidity of the primaries is estimated to be 18 GV. A method is suggested by which it should be possible to shift the median to lower rigidities. (*In German.*) Untersuchungen an einer Anordnung zur Messung der Nukleonenkomponente der kosmischen Strahlung. ***W. Lotz, A. Sittkus, and W. Hassler.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 296-300.

9613* The Action of Fast Spherical Ionization Chambers. Theoretical equations are presented representing the formation of pulses in fast spherical ionization chambers, with special reference to pulse height as a function of the position of the ionizing event in the chamber. ***R. D. Connor.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 301-308.

9614* On the Mechanism of Multiple Discharges in Self-Quenching Geiger Counters. In pure ethyl alcohol filled tubes the plateau slope and the breakdown region were due to multiple pulses of the same order of magnitude as the "ordinary" pulses. These multiple pulses were produced always immediately after the recovery time. The same process has been observed for ethyl alcohol-argon gas mixture filled tubes. ***O. J. Orient.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 309-322.

9615* Millimicrosecond Pulsing—Its Application and Technique. A terminal pulsed Van de Graaff generator is capable of delivering 500 μA and more peak currents in bursts 2-10 millimicrosecond time duration at arbitrary repetition rates. It is shown how millimicrosecond intervals of time relative to these bursts can be measured and recorded. ***W. M. Good.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 323-330.

9616* Detection of Low Energy Neutrons With A NaI(Tl) Crystal and Time of Flight. A NaI(Tl) crystal has been substituted for a plastic scintillator in conventional neutron time of flight apparatus. The characteristics of this neutron detection system have been studied using pulsed low energy neutrons from the $Li^7(p,n)$ reaction. ***R. Ballini and S. M. Shafroth.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 331-336.

9617* Some Factors Affecting the Gain and Resolution of Photomultiplier Tubes. Changes in the gain and resolution of photomultipliers of the DuMont type are examined with reference to changes in counting rate, axial magnetic fields and temperature. While the magnitudes of these variations are found to vary as between photomultipliers, graphs are given showing typical dependences. ***R. D. Connor and M. K. Husain.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 337-342.

9618* An Investigation of Properties of Thin Lithium Films by Use of the $Li^7(p,n)Be^7$ Reaction. The (p,n) reaction in thin films of lithium and lithium fluoride evaporated on tantalum backings is used to obtain a quantitative measure of possible irregularities in the thickness of such films. Evidence is presented that metallic lithium films are not only nonuniform in thickness but also that this apparent nonuniformity becomes more pronounced as these films are bombarded with protons. ***J. E. Monahan and F. P. Mooring.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 343-353.

9619* A Nuclear Magnetic Resonance Spectrometer. A bridge and pre-amplifier system for observation of nuclear magnetic resonance at various frequencies is described. ***V. J. Kowalewski and R. A. Hoffman.*** *Nuclear Instruments and Methods*, v. 6, Mar. 1960, p. 357-360.

9620* Symplectic Symmetry in the Nuclear Shell Model. The nature of the general two-particle interaction which is compatible with symplectic symmetry in the *jj* coupling shell model is investigated. The essential result is that, to within an additive constant and an additive multiple of T^2, the interaction should have the form of a sum of scalar products of single-particle tensors which have odd rank in the single-particle j space. An example of an interaction satisfying these conditions is a central interaction with $\sigma_1 \cdot \sigma_2$ exchange nature. ***J. B. French.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 393-410.

9621* Proton Capture in Be^7. Cross section for proton capture by Be^7 measured at bombarding energies of 800 keV and 1400 keV are 0.48 ± 0.18 and 0.50 ± 0.20 μb, respectively, from which the corresponding cross section factors are $S = 0.027 \pm 0.010$ and 0.017 ± 0.007 keV·b. The reaction is therefore important in stellar energy production only in stars operating on the proton-proton chain at temperatures greater than about 2×10^7 degrees Kelvin. ***Ralph W. Kavanagh.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 411-420.

9622* Small Angle Scattering of Electrons. The small angle scattering of 615 keV electrons was studied on N, A, Kr and Xe gases. If the electron cloud of atoms is considered in Hartree representation, for angles covered by the measurements, the differential cross sections for elastic and inelastic scattering are in agreement with the theory. ***I. Berkes and I. Demeter.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 421-435.

9623* $(\gamma, \begin{smallmatrix} np \\ d \end{smallmatrix})$ Reactions in S^{32}, Ca^{40}, Ge^{70}. A detailed study, up to 31 MeV, of the (γ,np) and (γ,d) reactions in S^{32}, Ca^{40}, and Ge^7 has been carried out, together with the study of the other processes: (γ,n), (γ,Tn) (γ,Tn) $E_n \geq 5.5$ MeV. In the case of S and Ca it is found besides that the neutron spectrum associated with the above reaction is much more energetic than could be explained on the basis of a simple evaporation process. ***F. Ferrero, S. Ferroni, R. Malvano, S. Menardi, and E. Silva.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 436-451.

9624* Energy and Angular Dependence of the Left-Right Asymmetry of D—D Neutrons Scattered by Carbon. The left-right asymmetry in the intensity of neutrons from the D-D reaction, scattered by carbon, was measured for deuteron energies between 300 and 500 keV with a gold "drive-in" target. The polarization vector was turned by the magnetic field of a solenoid, and the detectors remained in a fixed position. ***P. S. Dubbeldam, C. C. Jonker, and H. J. Boersma.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 452-463.

9625* On the Construction of the *S* Matrix for Dressed Particles. The problem of setting up the S matrix for dressed particles is considered by representing the unperturbed states of the dressed particles by means of asymptotic states and by assuming an exponential structure of the vacuum state. Auxiliary

independent fields are introduced to describe dressed particles and the scattering theory is formulated in terms of operators and state vectors in the auxiliary field space. ***Yu. Novozhilov.*** *Nuclear Physics*, v. 15, no. 3, Mar. 1960, p. 469-479.

9626 Measurement of Air Blast Effects From Simulated Nuclear Reactor Core Excursions. Tests were conducted to evaluate methods of simulating on a small scale the effect of nuclear reactor "runaway" on a containment shell surrounding the reactor. Additional tests were conducted with explosive charges bursting water-filled simulated reactor core vessels. These test results showed that shock waves were formed in air close to bursting vessels, and that the pressure-time histories differed considerably from the "classical" free air blast waves from bare charges. ***Wendell C. Olson, Richard J. Larson, and Harry Goldstein.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 199-209.

9627 The Decay of a Thermalized Neutron Pulse. A procedure is given for the exact solution of the Fourier-transformed, multivelocity transport equation in an infinite medium. The objective is the calculation of the decay constant of the thermalized neutron flux following an initial pulse of fast neutrons. The procedure is first illustrated for the case of isotropic scattering and then generalized to anistropic scattering by using the spherical harmonics expansion. ***Mark Nelkin.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 210-216.

9628 Methods and Cross Sections for Calculating the Fast Effect. The Spinrad three-group theory of the fast effect is formulated. Methods are presented for determining the necessary cross sections directly from fundamental data and three-group cross sections for various materials are tabulated. A comparison is made between the three-group theory and one-group theory with respect to the calculation of R, the ratio of fast-to-thermal fissions, and it is found that the three-group theory appears to give better agreement with experiments. ***Morton R. Fleishman and Harry Soodak.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 217-227.

9629 Neutron Absorption by Control Rods of Varying Transparency. Neutron fluxes and currents in the vicinity of control rods inside reactors are calculated in age-diffusion theory, using a control rod in the form of an infinite plane slab and approximating its transparency by a simple analytical expression. The results are compared with a two-group calculation for the same geometry and indicate the degree of accuracy of the latter method. The comparison is made for epithermal neutron energies only. ***H. Überall.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 228-234.

9630 A Useful Analogy for Single-Group Neutron Diffusion Theory. It is shown that an analogy exists between the neutron flux as predicted by single-group neutron diffusion theory and the axial component of the electric field intensity in a field excited as a plane transverse-magnetic wave in a cylindrical cavity. The buckling of a homogeneous bare core could be determined using simple microwave devices to an accuracy on the same order as the uncertainty of the cavity dimensions. ***James R. Melcher.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 235-239.

9631 Slowing Down of Neutrons in Graphite Close to Thermal Equilibrium. Elastic and one-phonon inelastic scattering cross sections of neutrons in graphite have been calculated for neutron energy less than 2000 k_0. Assuming that close to equilibrium the neutron distribution remains Maxwellian, the time variation of the temperature of this distribution has been calculated. The slowing down relaxation time near equilibrium comes out to nearly 170 μsec, which compares well with the experimental value of 185 $\pm$ 45 μsec. ***L. S. Kothari and P. G. Khubchandani.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 240-244.

9632 Correlation of Burnout Heat-Flux Data at 2000 psia. It is shown that the burnout heat-flux decreases as mass velocity increases for a constant burnout enthalpy in the quality range. Also, a comparison of the developed correlations based upon data for uniformly-heated channels was made with 25 burnout data points for channels having a cosine-shaped axial heat-flux distribution. The cosine data fall on the average of about 30% below the burnout heat-flux values for uniformaly heated channels. ***Donald W. Bell.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 245-251.

9633 Calculation of the Effective Resonance Integral of U^{238}. Methods for determining an effective resonance integral from available resonance parameter data are examined and applied to lumped systems where the absorber is U^{238}. Agreement with the experiment is satisfactory in view of an uncertainty of about 10% introduced by probable errors of the parameter data. ***A. R. Vernon.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 252-259.

9634 Comparison Theorems for the Estimation of Average Collision Probabilites. II. A previous paper of the author, in which theorems are given for the estimation of average collision probabilities for convex solids of irregular shape by comparison with solids for which the average collision probability is known, is extended. ***Lawrence Dresner.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 260-262.

9635 Experimental Check of a Monte Carlo-Calculated Distribution of Resonance Neutron Capture in a Gold Rod. A Monte Carlo calculation of the spatial distribution of resonance neutron capture across a 0.387-in. diameter gold rod is compared with the corresponding measured distribution. The difference between the Monte Carlo calculation and the measurement is attributed to relatively unshielded capture at energies above 250 ev, the starting energy for neutrons in the Monte Carlo calculation. ***Judson Hardy, Jr., G. G. Smith, and D. Klein.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 263-267.

9636 The Time-Dependent Importance of Neutrons and Precursors. Several normalizations or final boundary conditions are proposed which include as special cases the conventional interpretations of the adjoint function in a just critical reactor. In particular, for a noncritical reactor, the equivalence is introduced as the number of neutrons and precursors distributed in the persisting solution that would replace one neutron or precursor with equivalent asymptotic results. ***Jeffery Lewins.*** *Nuclear Science and Engineering*, v. 7, Mar. 1960, p. 268-274.

9637 Nuclear Spectroscopy. Part A. Discusses: (1) spectroscopy of charged particles: interactions of charged particles with matter, charged-particle detectors, measurement of spectra, and other problems, (2) gamma-ray spectroscopy: interaction of γ rays with matter, detection of γ rays and other problems, (3) neutron spectroscopy: interaction of neutrons with matter, techniques of slow neutron spectroscopy, measurements of fast neutron spectra, and (4) other topics: photonuclear reactions measurement of very short lifetimes and other problems. ***Fay Ajzenberg-Selove, editor.*** v. IX. 621 pp. 1960. Academic Press, New York. (QC784 N88)

9638 The Engineering Design of Power Reactors. Nuclear power reactors are large, complex, and expensive. Their design requires a "project approach"--an integration of many individual efforts and areas of technical knowledge. In system complexity and technical fluidity, power reactors rival such modern engineering feats as aircraft and missiles. Because it is a one-of-a-kind proposition, a power reactor must be built without full-scale testing. In addition, even if it does not work, it must not fail. The potential hazard associated with power reactors is so great that nuclear designers cannot risk the slighest chance of failure. This series of articles gives a survey of the steps in the design process, discussing the various problems, fields of technology and requirements involved. During the first step, the conceptual design stage, three points of view enter in--the customer's, the public's, and the designer's. Starting from the basic or conceptual design, the project works to produce a reference design that optimizes performance without sacrificing reliability. The project team is made up of a project manager, reactor physicists, thermal engineers and mechanical engineers. Development of the reference design has been broken down into eight tasks: (1) establishment of design criteria to form a basis for the final design and rough estimates of the remaining variables to be determined during the reference-design phase, (2) steady state parametric studies to relate physical properties and key core dimensions to temperature and hydraulic limits and criticality and reactivity requirements, (3) core and vessel layout in an arrangement commensurate with the reactor parameters already evolved, (4) flattening out variations in fuel temperatures throughout the core, (5) reference fuel design and development, (6) reactivity requirements and control rod design, (7) transient studies to evaluate the reactor's behavior and reliability for off-design-point conditions. After the reference

design has been evolved, development work is carried out on the various hardware involved. On the basis of this work, a revised reference design is evolved and at last the final design which contains detailed layout and design drawings from which the components can be manufactured. It includes materials specifications, and manufacturing, shipping, and installations procedures, and is usually accompanied by a final safeguards report. ***Nunzio J. Palladino and Harold L. Davis.*** *Nucleonics*, v. 18, June 1960, p. 85-116.

9639 Transient Temperature Variations During the Self-Heating of a Plasma by Thermonuclear Reactions. The ion and electron temperature variations in an idealized controlled thermonuclear reactor burning various ratios of deuterium and tritium are calculated. The variation in the fraction of energy deposited to the nuclear and electron gases with temperature is specifically included. One qualitative result is that it would be unsafe to assume nuclear temperature always equal to or greater than electron temperature for a nuclearly reacting plasma with tritium concentration greater than 10%. ***Howard D. Greyber.*** *Physical Review*, v. 117, 2nd ser., no. 1, Jan. 1, 1960, p. 43-44.

9640 Range Straggling of Charged Particles in Be, C, Al, Cu, Pb, and Air. The calculations extend up to $T/\mu c^2 \sim 100$, where T is the kinetic energy and μ is the mass of the incident article. At high energies ($T/\mu c^2 \gtrsim 5$), the integral giving the range straggling becomes somewhat dependent on the ratio μ/m, where m is the electron mass. Two separate calculations have therefore been carried out, which apply to protons and μ mesons, respectively. ***R. M. Sternheimer.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 485-488.

9641 Double Beta Decay. Formulas for the probability of double β decay including energy distributions and angular correlations of the emitted electrons according to the theory of Feynman and Gell-Mann are given. A strong dependence on the change of angular momentum exists. ***Lothar Meichsner.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 489-491.

9642 Anomalous Electric Dipole Conversion Coefficients in Odd-Mass Isotopes of the Heavy Elements. The data are consistent in every case with the interpretation that the $E1$ conversion coefficients in the L_{III} shell agree with the theoretical, model-independent coefficients calculated by Sliv and Band and by Rose. It is definitely established in several well-measured cases that the L_I and L_{II} coefficients are substantially larger than the theoretical values. ***F. Asaro, F. S. Stephens, J. M. Hollander, and I. Perlman.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 492-505.

9643 Excited Levels in Mn^{56}. The half-lives of the first three excited levels of Mn^{56} have been measured by looking at the cascade gamma rays from neutron capture in Mn^{55}. They are found to be 10.7^{+2}_{-3} mμsec, 4.9 ± 0.6 mμsec, and ≤ 0.5 mμsec. A fairly plausible assignment of spins and parities of the first, second, and third excited levels of Mn^{56} would seem to be 2^+, 1^+, and 2^+, respectively. ***N. D'Angelo.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 510-513.

9644 Excitation Study of $F^{19}(n,\alpha)N^{16}$ With a BaF_2 Crystal. The scintillation properties of crystalline BaF_2 have been investigated. It was found that this substance yields a reasonably well-defined photopeak when exposed to gamma rays from Na^{22}. With DuMont K1306 and 6292 photomultipliers, the signals from BaF_2 are about 1/5 to 1/10 as strong as those from NaI(Tl). ***Daniel M. Smith, Norman A. Bostrom, and Emmett L. Hudspeth.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 514-516.

9645 Radioactive Decay of Lutetium-174. Ytterbium oxide enriched to 98.4% in the 174 mass number was irradiated with 6-Mev protons. An activity of approximately 165-day half-life was produced and assigned to Lu^{174} by the identification of the Yb K X-ray and of the activities produced by similar proton irradiations of the other enriched isotopes of Yb. The observed activity of Lu^{174} consists of the L and K X-rays of Yb and 76.6- and 1228-kev gamma rays which are in coincidence. ***R. G. Wilson and M. L. Pool.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 517-519.

9646 Nuclear Orientation of Mn^{56}. The angular distribution of circular polarization of the gamma rays emitted from 2.6-hr Mn^{56}, polarized at low temperatures in Ce Mg nitrate, have been measured. ***Rudolf W. Bauer and Martin Deutsch.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 519-525.

9647 Alpha-Alpha Scattering in the Energy Range 5 to 9 Mev. A phase-shift analysis has been performed which indicates that only the S- and D-wave phase shifts are necessary to fit the data in this energy region. Only the well-known D state at approximately 2.9 Mev in Be^8 was observed. The D state has been compared to the single-level dispersion theory and level parameters have been extracted which are compatible with the alpha-particle model of Be^8. ***C. M. Jones, G. C. Phillips, and Philip D. Miller.*** *Physical Review*, v. 117, 2nd ser., no. 2, Jan. 15, 1960, p. 525-530.

9648 Slow-Neutron Scattering by Rotators. II. The methods developed in a previous paper for extending the neutron scattering formalism of Zemach and Glauber to any type of molecular rotator have been employed to derive generalized forms of the differential cross sections for rotator scattering. A mass-ratio expansion for the treatment of the high-energy limit is illustrated on the classical cross section and then employed in the treatment of the more general quantum-mechanical expression for the differential cross section. ***Howard C. Volkin.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 1029-1036.

9649 Elastic Scattering of Nitrogen by Carbon. The differential cross section for the elastic scattering of N from thin C foils was measured from about 40° to about 140° in the center-of-mass system. The measurements were made at three energies: 27.3 Mev, 23.5 Mev, and 21.5 Mev, mean energy in the 1-Mev thick targets. The angular resolution was about 1°. Scattered N and recoil C atoms were counted in coincidence. ***M. L. Halbert, C. E. Hunting, and A. Zucker.*** *Physical Review*, v. 117, 2nd ser., no. 6, Mar. 15, 1960, p. 1545-1551.

9650 The Polarization in Neutron-Proton Scattering at 77 Mev. The beam of polarized neutrons was produced by proton irradiation of a Be target. The neutrons emerging at a production angle of 55° were 23.7 ± 1.8% polarized, the beam polarization being measured by using the calculable polarization dependence of small angle scattering from U. In the neutron-proton experiment, an angular range from 20.6° to 159.2° was covered detecting either scattered neutrons or recoil protons. ***C. Whitehead, S. Tornabene, and G. H. Stafford.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 345-356.

9651 Shock Waves and Controlled Thermonuclear Fusion. The classical shock-heating process is analyzed and it is shown that shock heating alone is unlikely to yield temperatures in excess of the order of 3×10^6 deg K with present-day techniques. The temperature may be increased in principle to a value required for power production by isentropic compression after the shock-heating phase. ***J. K. Wright.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 412-420.

9652* On Isotope Labelling and the Initiation of Chemical Reactions by Electrical Discharge. Shows that Wilzbach tritium labelling of organic compounds and similar reaction can be performed in one minute instead of in weeks. From experimental data it was calculated that 20–50% of the electrical energy is equivalent to ionizing radiation. Hence, industrial gaseous reactions may be performed more cheaply by electrical discharge than by ionizing radiation. (*In Swedish.*) Om isotopmärkning och initiering av kemiska reaktioner i elektriska urladdningar. ***Torbjörn Westermark.*** *TVF, Teknisk-Vetenskaplig Forskning*, v. 31, no. 3, 1960, p. 122-124.

9653* On Fermi Resonance in the Case of Carbon Tetrachloride. In the case of gaseous CCl_4 the theoretical value of the splitting ν and the ratios of the intensities of the resonating compounds agree satisfactorily with the experimental results. The distances Δ between unperturbed levels and the unperturbed frequencies of the fundamental modes of the gaseous and the liquid CCl_4 molecule, were determined. (*In Ukrainian.*) Do pytannia pro rezonans Fermi u vydanku chotyrykhlorystogo vuglʹtsiu. ***M. P. Lisitsa and V. L. Strizhevsky.*** *Ukrains'kyi Fizichnyi Zhurnal*, v. 5, no. 1, Jan.-Feb. 1960, p. 34-39.

9654 High-Temperature Irradiation of Metals and Graphite in Flowing Helium. As part of the coolant-core evaluation

studies in an early phase of the Maritime Gas-Cooled Reactor (MGCR) program, Ni, K-Monel, Nb 1 w/o Zr, and graphite were irradiated in a convective flow of He. A capsule of novel design was used to study the corrosion of the metals at 1500 F and 960 F in a 243-hr BRR experiment. No attack of the Ni and Nb-1 w/o Zr was observed at either temperature. Metallographic examination did show a 1 to 2.5-mil attack of the K-Monel at 1500 F in a torus containing no getter. ***Neil E. Miller, Donald J. Hamman, Ward S. Diethorn, and William H. Goldthwaite.*** *U. S. Atomic Energy Commission, BMI*-1419, Feb. 23, 1960, 16 pp. (UF767 U3b Contin.)

9655 Irradiation-Capsule Study of Uranium Monocarbide. Small cylindrical specimens of enriched uranium carbide were irradiated in the MTR as part of a program to evaluate for Atomics International the usefulness of uranium carbide as a high-temperature fuel for stationary power reactors. Detailed thermal and nuclear analyses were made to arrive at an appropriate capsule design on the basis of target specimen centerline temperature (−1500 F), specimen surface temperature (1100 F), specimen composition (uranium −5 w/o carbon), and a capsule OD of 1.125 in. Temperature data from thermocouples inside the capsules indicated that five of the six capsules irradiated had operated at close to the design conditions. ***Robert B. Price, David Stahl, John H. Stang, and Eugene M. Simons.*** *U. S. Atomic Energy Commission, BMI*-1425, Mar. 2, 1960, 38 pp. (UF767 U3b Contin.)

9656 The BMI-16 Recirculating Gas Loop Installed at the ETR. A developmental program was conducted to provide an in-pile loop facility for use in evaluating gas-cooled reactor fuel subassemblies. The program included the design, construction, and installation of a recirculating gas loop which is located in a 6 by 6-in. facility in the Al reflector of the ETR. The loop system was designed to recirculate the primary N coolant at flow rates up to 0.9 lb per sec and pressures up to 200 psia. It will accept fuel subassemblies up to 36 in. in length and 2.26 in. in diameter with specimen power generation up to 150 kw. The maximum coolant temperature at the specimen outlet is set at 1500 F. ***Joseph V. Baum and Gerald A. Francis.*** *U. S. Atomic Energy Commission, BMI*-1429, Mar. 18, 1960, 44 pp. (UF767 U3b Contin.)

9657 Specifications for Swaged UO_2 19-Rod Cluster, PRTR Fuel Element Mark I. The first uranium dioxide fuel loading for the Plutonium Recycle Test Reactor consists of Zircaloy-2 clad, swaged, 19-rod cluster fuel elements. These fuel elements are unique in that they represent the first large-scale demonstration of the use of a combination of (1) nonsintered, swaged fuel in a high-temperature reactor, and (2) nonsegmented, long fuel rods. ***M. K. Millhollen.*** *U. S. Atomic Energy Commission, HW*-64359, Mar. 15, 1960, 31 pp. (UF767 Un3.1hw Contin.)

9658* Materials Testing With Radioactive Isotopes. Tagged elements are employed for density-wear tests, in metallography, in corrosion research and in analytical chemistry. By measuring the absorption and scatter of nuclear rays in and on the material the surface weights and compositions of substances can be determined. (*In German.*) Materialprüfung mit radioaktiven Isotopen. ***Rudolf Neider.*** *VDI Zeitschrift,* v. 102, no. 11, Apr. 11, 1960, p. 424.

9659* Investigation of the Direct Pair Production by Means of Electrons. The direct production of electron-positron-pairs by 31·5 MeV-electrons has been investigated using a counting device. The external electron beam of a betatron, collimated and by deflection cleaned of photons, passed through a thin copper foil, and was collected in a Faraday cup. The fast positrons emerging from the foil were analyzed in a magnetic field and detected by a plastic scintillator. (*In German.*) Untersuchung der direkten Paarbildung durch Elektronen. ***L. Criegee.*** *Zeitschrift für Physik*, v. 158, no. 4, 1960, p. 433-443.

See also: **8722** (glass for disposing fission products); **8764** (radiation in chemical industry); **8962** (decontamination testing of coatings); **9694** (radiation effects).

OPERATIONS RESEARCH

9660 Behavior of Industrial Work Groups. Prediction and Control. Provides a method of predicting the behavior of work groups based on their structural characteristics. Emphasizes the differences that exist between work groups rather than the similarities. Relates these differences to the technology of the plant and demonstrates how management predetermines its own human relations problems by prescribing the flow of work. ***Leonard R. Sayles.*** 182 pp. 1958. John Wiley & Sons, New York. (HD6974 Sa99b)

9661* The Theory of Games. The coinventor of this theory briefly describes its applications. ***Oskar Morgenstern.*** *Challenge*, v. 8, no. 6, Mar. 1960, p. 35-43.

9662 Materials Management Concept Stirs PA Debate. Should all flow of purchased materials be centralized in a single purchasing authority? It's the hottest procurement subject since value analysis arrived. ***G. J. McManus.*** *Iron Age*, v. 185, no. 9, Mar. 3, 1960, p. 64-66.

9663* An Experimental Investigation of Priority Dispatching. Priority rules can differ with respect to the mean completion time or mean lateness of all jobs as well as with the values for individual jobs. A priority rule can do more than accelerate one or more jobs at the expense of others—it can accelerate the average of all jobs. ***Richard W. Conway, Bruce M. Johnson, and William L. Maxwell.*** *Journal of Industrial Engineering*, v. 11, no. 3, May-June 1960, p. 221-229.

9664* Industrial Engineers, Incentive Systems, and the Contract. Discusses, on a general level, the main points and problem areas which one encounters in working with incentive systems. The author asserts that an understanding of these areas together with better teamwork at the negotiation stage of the incentive system, will result in a more effective collective bargaining structure and, a fortiori, a more effective incentive system. ***Charles A. Werner.*** *Journal of Industrial Engineering*, v. 11, no. 3, May-June 1960, p. 231-236.

9665* A Research Approach in Management Controls. Research in management controls poses many challenging problems and many promising rewards. Decision rules which formalize the actions to be taken for specified conditions should improve control through predictability of response. The computer, rather than serving merely as a huge data-processing device, can be used for on-line control via simulation and data analysis. ***Alan J. Rowe.*** *Journal of Industrial Engineering*, v. 11, no. 3, May-June 1960, p. 251-258.

9666 Linear Programming Methods and Applications. Mathematical background, the general linear-programming problem, simplex computational procedure, duality problems of linear programming, the revised simplex method, degeneracy procedures, parametric linear programming, additional computational techniques and other problems are discussed. ***Saul I. Gass.*** 223 pp. 1958. McGraw-Hill, New York. (Z6654.P75 R45L)

See also: **9237** (El Salvador Mo concentration).

ORE AND MATERIALS BENEFICIATION

9667* Enriching of Uranium Ores. (*In Hungarian.*) Uránércek dúsítása. ***Troyan D. Georgieff, Béla Janisky, and Vince Siska.*** *Bányászati Lapok*, v. 93, no. 4, Apr. 1960, p. 257-264.

9668* Fluidised Roasting of Pyrites. Competing with the modern multi-hearth furnace methods, this process yields cinders suitable for the iron and steel industry. *British Chemical Engineering*, v. 5, May 1960, p. 326-329.

9669 Reduction Experiments on Iron Ores and Sinters. The possibility of measuring the effect of the Boudouard reaction and of the decomposition of the combined water and carbonates upon the iron oxide reduction was demonstrated. An evaluation of results for sinters and various iron ores is given. ***E. Schürmann, G. Heynert, and H. Beer.*** *Henry Brutcher Translation No.* 4663, 29 pp. (From *Stahl und Eisen*, v. 79, no. 13, 1959, p. 917-926.) Henry Brutcher, Altadena, Calif.

9670* Fundamentals of Settling Operation and the Technical Development of Settling Tanks. The standard settling machine in Western Germany is characterized by two settling tanks, located one behind the other, which are separated from each other by two bridges. The French have developed a fine

grain settling machine. The new fine grain settling machines of German construction are characterized by rapid transport of the heavier part of material. (*In German.*) Grundlagen der Setzarbeit und technische Entwicklung der Setzmaschinen. ***Edwin Hoffmann.*** *Glückauf; Bergmännische Zeitschrift*, v. 96, no. 8, Apr. 9, 1960, p. 481-494.

9671 Sinter-Plant Assessment Trials at Barrow Ironworks, Ltd. A trial was carried out on the Dwight-Lloyd sinter strand recently commissioned at Barrow Ironworks. This plant contains several new features, the most notable of which is the facility for using preheated air for sintering after ignition; in addition, the plant is fitted with constant-weight feeders for controlling raw material input rates, quenching trommel for cooling raw material input rates, quenching trommel for cooling the return fines, and a Davidson cellular-type dust collector. ***D. F. Ball.*** *Iron and Steel Institute, Journal*, v. 194, pt. 3, Mar. 1960, p. 351-360.

9672* Flotation of Some Oxidized and Nonmetallic Ores. Amine process in zinc flotation, flotation of U minerals and monazite, flotation of chrysocolla (copper silicate) are discussed. Results of three research projects are reviewed. ***William C. Aitkenhead and John A. Jaekel.*** *Mining Congress Journal*, v. 46, May 1960, p. 50-54.

9673 Effect of Temperature on Soap Flotation of Iron Ore. ***Strathmore R. B. Cooke, Iwao Iwasaki, and Hyung Sup Choi.*** *Mining Engineering*, v. 12, May 1960, p. 491-498.

9674* Determination of the Yield of a Flotation Concentrate. A new method was developed consisting in the direct weighing of the dry substance of a specimen formed by separate average parts of the flotation concentrate. Only a small average part of the foam is captured from the total mass of the concentrate with which it is in a certain weight relationship. The yield is determined by simple addition of the weights of all partial specimens extracted from the flotation cell. (*In Czech.*) Stanovení výnosu flotačního koncentrátu. ***J. Hřebačka.*** *Paliva*, v. 40, no. 4, Apr. 1960, p. 114-117.

9675* Testing of Water Hardness for Zinc and Lead Ore Flotation Purposes. The following points were studied: importance of water quality for flotation purposes, defining the hardness of water on various stages of dressing schemes, causes of water hardness, the working of $CaSO_4$ on lead and zinc sulfide and markasites, and drawbacks of water hardness on useful minerals flotation. (*In Polish.*) Badanie wpływu twardości wody na flotację rud cynkowoołowiowych. ***Wiesław Długosz.*** *Rudy i Metale Niezelazne*, v. 5, no. 4, Apr. 1960, p. 153-157.

9676* Testing Furnaces With Fluidized Bed for Magnetic Conversion of Iron Ores. The successful tests, carried out in a pilot plant, have proved the possibility of magnetic conversion in a fluidized bed of the Krivoy Rog oxydized quartziferous iron ores and of the Kertch brown iron ores with the subsequent magnetic concentration of the calcined ores. An experimental commerical size installation has been designed. (*In Russian.*) Ispytanie pechi s kipiashchim sloem dlia magnetiziruiushchego obzhiga zheleznykh rud. ***V. I. Karmazin, K. E. Makhorin, G. V. Gubin, A. M. Kucher, V. E. Gasparian.*** *Stal'*, v. 20, no. 4, Apr. 1960, p. 289-293.

9677* Production of Fluxed Sinter From Kertch Brown Iron Ores. To produce high-grade sinter from the concentrates, received after calcination and magnetic concentration of Kertch brown iron ores, it is expedient, first to maintain the optimum moisture content of the sintering mixture and to increase fuel consumption rate as the basicity of the sinter increases. (*In Russian.*) Poluchenie ofliusovannogo aglomerata iz kontsentrata kerchenskoi tabachnoi rudy. ***Z. I. Nekrasov, N. A. Gladkov, and A. G. Ul'ianov.*** *Stal'*, v. 20, no. 4, Apr. 1960, p. 293-298.

9678* Distribution of Cadmium, Rare and Minor Elements in Products of Copper-Zinc Concentrate Flash Smelting With Oxygen Blast. The investigation of the distribution of rare and minor elements in products of flash smelting with oxygen blast in seminanufacturing installations showed a sharp loss by passage of these elements as dust and sublimates, compared with the usual reverberatory smelting. On smelting with oxygen blast about 80% of Cd and Te, 65% of Tl, 60-70% of Se, 40% of In and 30% of Ge are lost in dust and sublimates. (*In Russian.*) Raspredelenie kadmiia, redkikh i rasseiannykh elementov po produktam plavki medno tsinkovykh kontsentratov vo vzveshennom sostoianii na kislorodnom dut'e. ***V. I. Deev, M. I. Kotchnev, A. I. Okunev, and B. I. Sergin.*** *Tsvetnye Metally*, v. 33, no. 4, Apr. 1960, p. 19-24.

9679* Direct Production of Sponge Iron by Fluidization of Pyrite Cinders. Direct winning of Fe from pyrite cinder (cyclone dust) was developed by reducing calcination and fluidization with generated and natural gases. A method of preventing the clinkering of granulated dust in the temperature range of 850-930° has been developed. (*In Russian.*) Priamve poluchenie gubchatogo zheleza iz piritnykh ogarkov v kipiashchem sloe. ***G. I. Damskaya, S. S. Tikhonov, and G. T. Leiserovich.*** *Tsvetnye Metally*, v. 33, no. 4, Apr. 1960, p. 28-33.

9680 Flotation of Low-Grade Mercury Ores. Five ore types studied were found amenable to flotation. ***J. W. Town, R. S. McClain, and W. A. Stickney.*** *U. S. Bureau of Mines Report of Investigations* 5598, 1960, 34 pp. (TN21 Un3r Vis.)

9681* Concerning Flocculation and Flotation. Shows how sedimentation processes are determined by the mutual adhesion of sedimenting particles and how the aggregation is expressed by different measuring methods. Surface energy of solids can be evaluated. The filling of the boundary surface active molecules results in minimal sediment volumes and aggregation constants which correspond to the so-called critical micelle forming concentration. (*In German.*) Über Flockung und Flotation. ***E. Bischoff.*** *Zeitschrift für Physikalische Chemie* (Leipzig), v. 213, nos. 5-6, 1960, p. 265-288.

See also: **9222** (temperature variations on coal contact angles); **9224** (underground gasification of coal).

PHYSICS

9682 Basic Physics in Radiology. Statics, the study of forces, dynamics, the study of motion, heat, magnetism electrostatics, introduction to current electricity, the supply and consumption of electrical energy, the chemical effects and magnetic effects of an electric current, electromagnetic induction, alternating currents, waves and the propagation of radiant energy, and some optical instruments used in radiology are discussed. ***L. A. W. Kemp and R. Oliver.*** 329 pp. 1959. Charles C. Thomas, Springfield, Ill. (QC475 K32b)

9683 Capillary Systems. v. II. Applications. Discusses electro-osmosis, capillary flow and analysis of porosity, osmosis and dialysis, the dialysis, the electrodialysis, electrodecanting and electrofiltration, filtrations, the convective drying by evaporation, and impregnations. (*In German.*) Kapillarsysteme. v. II. Anwendungen. ***Erich Manegold.*** 1527 pp. 1960. Strassenbau, Chemie und Technik Verlagsgesellschaft m. b. H., Heidelberg, West Germany. (QC183 M31k)

9684* Development of Motion, According to the Theory of Jordan-Thiry, by the Method of Impulse-Energy Tensor. The purpose of this notice is to explain certain results which were affirmed in preceding papers. We are using the same notations. We like to establish the equations of motion of N internal ranges, using equations of the internal part. (*In French.*) Sur les équations de mouvement en théorie de Jordan-Thiry, par la méthode du tenseur impulsion-énergie. ***Aline Surin.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 10, Mar. 7, 1960, p. 1805-1807.

9685 The Conceptual Foundations of the Statistical Approach in Mechanics. The older formulation of statistico-mechanical investigations (kineto-statistics of the molecule), the modern formulation of statistico-mechanical investigations (kineto-statistics of the gas model) and the Gibbs' elementary principles in statistical mechanics are discussed in detail. ***Paul Ehrenfest and Tatiana Ehrenfest.*** 114 pp. 1959. Cornell University Press, Ithaca, N. Y. (QC175 Eh84btr)

9686* Origin of the Magnetomechanical Effect in an Alternating Field. Describes further experiments on the internal friction of Ni in an alternating magnetic field. It was found that the effect is not caused by macroscopic eddy currents but by microscopic eddy currents connected with changes in domain structure, which macroscopically have a reversible character and which appear both in the region of wall displacements and in the region of the rotation of magnetization vectors. ***K. Mišek.*** *Czechoslovak Journal of Physics*, v. 10, no. 2, 1960, p. 104-118.

9687 The Design of Physics Research Laboratories. A symposium held by the London and Home Counties Branch of The Institute of Physics, at the Royal Institution on Nov. 27, 1957. Topics discussed include the architect and physics; some problems in the planning of research laboratories; recent trends in the design of American industrial research facilities; services and facilities from the user's point of view; buildings and services from the viewpoint of the laboratory maintenance engineer; and research on the design of laboratories. 108 pp. 1959. Reinhold Publishing Corp., New York. (QC51 In7d)

9688 The Mechanism and Efficiency of Electroluminescence in ZnS Phosphors. Describes the application of a model of the electroluminescent process to the photon emission and power consumption of insulated electroluminescent phosphors as a function of voltage and frequency. ***F. F. Morehead, Jr.*** *Electrochemical Society, Journal*, v. 107, Apr. 1960, p. 281-287.

9689 Evaporation and Droplet Growth in Gaseous Media. Quasistationary evaporation and growth of droplets motionless relative to the medium, quasistationary evaporation and growth of droplets moving relative to the medium, nonstationary evaporation and growth of droplets. ***N. A. Fuchs.*** 72 pp. 1959. Pergamon Press, New York. (QC183 F95itr)

9690 Thermal Conductivity of Simple Molecules in the Condensed State. A model for the thermal conductivity of a liquid composed of spherically symmetric molecules is proposed. The theory permits calculation of the coefficient of thermal conductivity from the density, provided the force constants of the molecular interaction are known. The relative magnitude of "convective" and vibrational contributions is examined and the former is shown to be negligible. ***J. K. Horrocks and E. McLaughlin.*** *Faraday Society, Transactions*, v. 56, Feb. 1960, p. 206-212.

9691 Recombination of Atoms at Surfaces. VIII. The Three-Dimensional Diffusion Equation. The theory of Smith's experimental method for the determination of atomic recombination coefficients by a study of the decay of atom concentration along the axis of a closed cylinder is re-examined. A three-dimensional diffusion equation is derived and solved numerically. ***P. G. Dickens, D. Schofield, and J. Walsh.*** *Faraday Society, Transactions*, v. 56, Feb. 1960, p. 225-233.

9692* Some Features of Photoconductivity of Mercuric Sulphide. Generalized results of the investigation, if increase and decrease of the photoconductivity show that samples of α HgS belong to the photoresistant substances of the hyberbolic type of Se, InSe, Tl_2S, B_2S_3, CdS (at low temperatures). Photoconducting crystals of cinnabarite are sensitive to X-radiation. (*In Russian.*) Nekotorye osobennosti fotoprovodimosti sernistoĭ rtuti. ***N. I. Butsko.*** *Fizika Tverdogo Telo*, v. 2, no. 4, Apr. 1960, p. 629-632.

9693* Energy Spectrum of Holes in Diamond-Type Crystals. All peculiarities of the spectrum of holes can be obtained, using our investigation method. Analytical results of energy in a wide range of values of the quaziimpuls were obtained. (*In Russian.*) Energeticheskiĭ spektr dyrok v kristallakh tipa almaza. ***K. Ia. Shtivelman.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 644-650.

9694* Spontaneous Creation of F-Centers in Irradiated Alkali-Haloid Crystals After Annealing. The spontaneous creation of F-centers was observed in NaCl, KCl, KBr, and KI crystals, which were irradiated in the reactor and then subjected to annealing till the restoration of the transparency in visible light at temperatures of 200 to 450 C. The creation of F-centers is a result of interaction, caused by the activity created in the reactor with the material of the crystal (*In Russian.*) Spontannoe vozniknovenie tsentrov okrashivaniia v oblucheunykh shchelochno-galoidlnykh kristallark posle otzhiga. ***A. A. Vorobiev and B. V. Budylin.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 663-664.

9695* Antiseignette- and Seignette-Electric Properties of the $NaNbO_3$-$PbZrO_3$ Solid Solutions. The synthesis and investigation of dielectric properties of the system of solid solutions of two Antiseignette-electrics: $NaNbO_3$-$PbZrO_3$ were carried out. The origination of Seignette-electric phases was found. The causes of originating of Seignette-electricity in the given system are discussed. (*In Russian.*) Antisegneto- i segnetoelektricheskie svoĭstva tverdykh rastvorov $NaNbO_3$-$PbZrO_3$. ***N. N. Krainik.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 685-690.

9696* On the Nature of Transitional Processes of Conductivity in Seignette-Electrics. The present investigation is an attempt on the example of the polycrystalline barium titanate, the monocrystals of potassium sodium tartrate, guanidine-aluminum-sulfate hexahydrate and triglycine-sulfate to carry out an analysis of the obtained results for the purpose of examination of the nature and mechanism of the transitional processes of conductivity. (*In Russian.*) K voprosri o prirode perekhodnykh protsessov provodimosti v segnetoelektrikakh. ***V. M. Gurevich, I. S. Zheludev, and I. S. Rez.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 691-696.

9697* Secondary Electronic Emission of the Ice and Antracene Films. The investigation method of secondary electronic emission substances with a high elasticity of vapor was proposed and tested. The dependence of the coefficient of secondary electronic emission on the energy of primary electrons in the range of up from 200 to 2500 ev of ice and antracene films at a temperature of −180 C was measured. Secondary-emission properties of investigated dielectrics with a molecular type of bond are close to each other and from the viewpoint of secondary electronic emission they may be unified in one group. (*In Russian.*) Vtorichnaia elektronnaia emissiia plenok l'da i antratsena. ***T. L. Matskevich and E. G. Mikhailova.*** *Fizika Tverdogo Tela*, v. 2, no. 4, Apr. 1960, p. 709-715.

9698 Vibrations of Ferroelectric Transducer Elements Loaded by Masses and Acoustic Radiation. The motion, stress distribution, and electrical impedance are calculated for idealized three-layer sonic transducers, consisting of a piezoelectric element loaded at either end by a mass which may be distributed or lumped, and loaded further by resistive plane-wave acoustic radiation. ***F. Rosenthal and V. D. Mikuteit.*** *IRE Transactions on Ultrasonics Engineering*, v. UE-7, no. 1, Feb. 1960, p. 12-15. (TK1 In6.6u Vis.)

9699 Ionization Phenomena in Gases. Introduction, fundamental processes, the similarity principle, alternating and high-frequency discharges, ionization and excitation in the upper atmosphere, high-current discharges and thermonuclear effects, plasma oscillations and waves are discussed. ***Gordon Francis.*** 300 pp. 1960. Academic Press, New York. (QC702 F84i)

9700* Effect of Polarity in Liquid Ionizing Chambers. The relationship between ionization current and sign of voltage in chamber was studied. Effect of polarity depends on the additional difference of potentials in the chamber. This difference is independent of the intensity of irradiation and internal voltage on the ohmic proportion of the volt-ampere characteristic and beyond its range; it depends on the region of saturation. A way to eliminate the effect of polarity in plotting the volt ampere curve was shown. (*In Russian.*) Effekt poliarnosti v zhidkostnykh ionizatsionnykh kamerakh. ***V. I. Ivanov.*** Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Fizika, 1960, no. 1, p. 115-118.

9701* Spectral Investigations of the Complex Formation in the Phenol-Nitrobenzene System. The optical densities of some series of isomolar solutions of this system were studied. According to the change of the absorption spectra in the visible region for the mixture of phenol with nitrobenzene, a deduction is made about the formation in the system of complexes of the 1:1, 1:2, 2:1 composition. From the graphic relationship, the equilibrium constant and the coefficient of extinction of the complex of the 1:1 composition is calculated. (*In Russian.*) Spektral'nye issledovaniia kompleksoobrazovaniia v sisteme fenol-nitrobenzol. ***G. A. Gavrilov.*** Izvestiia Vysshikh Uchenbykh *Zavedeniĭ, Fizika*, 1960, no. 1, p. 208-216.

9702* Remarks About Certain Optical Properties and the Structure of Thin Silver Layers. Some experimental results dealing with the influence of the method of evaporation are given. Some theoretical models of film structures proposed by different authors are examined. (*In French.*) Remarques sur certaines propriétés optiques et sur la structure des couches minces d'argent. ***J. P. David.*** *Journal de Physique et le Radium*, v. 21, no. 3, Mar. 1960, p. 157-164.

9703* A Spectral Study of Luminescence Due to the Excitation of Rare Gases by Rays. Luminescence spectra of the noble gases He, A, Kr and Xe are studied under excitation by α rays. It is shown that the energy is transferred from excited levels of these gases to Hg and N_2 impurities for impurity concentrations respectively less than 10^{-6} and 10^{-4}. These results confirm previous measurements concerning the period of

luminescence and its variations versus N concentration in noble gases. (*In French.*) Étude spectrale de la luminescence due a l'excitation des gaz rares par les rayons α. ***Lydie Koch.*** *Journal de Physique et le Radium*, v. 21, no. 3, Mar. 1960, p. 169-173.

9704* Determination of Eddy Currents by Means of the Electric Vector Potential. This article shows a relatively simple method for eddy current calculation, making use of the vector potential of an induced electric rotational field. This vector is determined by an equation, where the integration extends over a closed unbranched induced magnetic contour. The method is based on Ohm's law in differential form, by applying Stokes' theorem. The results obtained can be used for practical calculation of electrical induction apparatus. (*In French.*) Détermination des courants de foucault au moyen du potentiel vecteur électrique. ***Mintcho P. Zlater.*** *Journal de Physique et le Radium* (Suppl.), v. 21, no. 3, Mar. 1960, p. 16A-18A.

9705* Measuring High Electric Resistances by Means of an Ionizing Chamber Used as a Current Source. Method allows measurement with great accuracy of resistances which have small values as compared to the internal resistance ρ of the chamber ($p = \Delta v/\Delta i$). Under atmospheric pressure, ρ is of the order of 10^{15} ohms; with air, under a pressure of 2 cm of Hg, ρ will be 10^{16} ohms. The upper limit of resistances which can be measured accurately, with this ionization chamber, is 10^{14} ohms. (*In French.*) Mesure des résistances électriques élevées a l'aide d'une chambre d'ionisation utilisée comme source de courant. ***Daniel Blanc, Eric Fort, Robert Lacoste, and Jean Lagasse.*** *Journal de Physique et le Radium* (Suppl.), v. 21, no. 3, Mar. 1960, p. 52A-56A.

9706 Lattice Displacements by Fast Electrons. A discussion is given of the process by which atoms are displaced from their lattice sites by incident fast electrons. In addition to direct displacement by the incident electron, expressions are derived for the fraction of atoms displaced by fast moving atoms and by fast secondary electrons, both of which are generated initially by the incident electron. ***W. Dale Compton and George W. Arnold.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 621-625.

9707 Mobility of Hydrogen and Deuterium Positive Ions in Their Parent Gases. For deuterium, the mobility was about 0.75 the value for H throughout the range of E/p_0. The experiment was performed with U-purified gas in an ultrahigh vacuum system. Ions were not identified as atomic, diatomic, or triatomic. ***D. J. Rose.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 643-645.

9708 Optical Absorption by Free Carriers in a Semiconductor Containing a Dispersed Colloidal Phase. The optical absorption by free carriers in a semiconductor containing a dispersed colloidal phase is treated, taking into account the dipolar diffusion of minority carriers about the particles. ***B. R. Gossick.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 648-649.

9709 Correlation Between Certain Extinction Bands of Solids and Plasma Resonance. A correlation is reported between certain optical extinction bands in sapphire, quartz, the silver and alkali halides, and the calculated plasma resonance of electrons in colloidal particles which are either known or expected to be present. This correlation suggests not only that pile neutrons produce Li particles in lithium fluoride, but Al particles in sapphire, and Si particles in quartz. ***B. R. Gossick.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 650-651.

9710 Motion of 180° Domain Walls in Metal Electroded Barium Titanate Crystals as a Function of Electric Field and Sample Thickness. The present paper contains quantitative measurements of the velocity of the sidewise motion of 180° domain-walls in $BaTiO_3$ crystals, most of which were electroded with 200-A thick films of Au. The field dependence of the wall velocity is the same as that reported previously for liquid electroded specimens. ***Robert C. Miller and Albert Savage.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 662-669.

9711 Formation and Initial Growth of Single-Asperity Solid-State Bonds. A gold needle point in contact with a gold flat has been used to study the formation and initial growth of single-asperity solid-state bonds. In the absence of external pressure, the growth of the bonded area can be expressed analytically by a diffusion-controlled rate equation. Values for the coefficient of self-diffusion determined from these experiments are in reasonable agreement with those given in the recent literature. ***F. C. Holden, J. B. Melehan, H. R. Ogden, and R. I. Jaffee.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 670-673.

9712 A Dynamic Hard Sphere Model. A simple two-dimensional model, in which uniform hard spheres are made to move steadily and apparently nearly at random, is described. At low sphere density the model exhibits "gas-like" behavior. As the density is increased the behavior becomes more "liquid-like" and then "crystallization" occurs. ***D. Turnbull and R. L. Cormia.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 674-678.

9713 On the Yield and Energy Distribution of Secondary Positive Ions From Metal Surfaces. In conformity with earlier investigations, it was found that an appreciable fraction of the ions was liberated with energies less than 5-10 ev, although some secondary ions of more than 200 ev were found. The distributions appeared to be at least partially Maxwellian in character. Although errors in measurements were large, there appeared to be little dependence of the yield of secondary ions on the mass of the bombarding ion. ***Henry E. Stanton.*** *Journal of Applied Physics*, v. 31, Apr. 1960, p. 678-683.

9714* Gauge Properties of Propagators in Quantum Electrodynamics. The effect of a change of gage on the propagators is studied systematically for quantum electrodynamics. Various gages are considered, among them the Coulomb, the Landau, the Feynman, and the Yennie gages. The equivalence of the various formulations of the theory is demonstrated. ***Bruno Zumino.*** *Journal of Mathematical Physics*, v. 1, no. 1, Jan.-Feb. 1960, p. 1-7.

9715* New Thermal Insulation Material for Commercial Refrigerated Equipment. A new honeycomb insulation material is made from strong paper impregnated with special waterproof resins or lacquers. The honeycomb structure formed by the films together with reflecting surfaces gives the material low thermal conductivity properties. The weight by volume of the material depends upon the thickness of air cells and varies from 20 to 40 kg/m³. The thermal conductivity coefficients is 0.033–0.045 kcal/m² hr. C. (*In Russian.*) Novyĭ termoizoliatsionnyĭ material dlia okhlazhdaemogo torgovogo oborudovaniia. ***N. Kudriashov.*** *Kholodil'naia Tekhnika*, v. 37, no. 2, Mar.-Apr. 1960, p. 30-35.

9716 Scintillators and Semiconductors. Scintillation theory; new scintillators; photomultiplier developments; recording particle tracks with the luminescent chamber; semiconductor detectors. *Nucleonics*, v. 18, May 1960, p. 85-100.

9717 Many-Body Problem in Quantum Statistical Mechanics. V. Degenerate Phase in Bose-Einstein Condensation. The formulation of the previous paper is extended. This extension is carried out by the introduction of an x-ensemble, which enables one to utilize an Ursell-type expansion. It is proved that in the presence of a Bose-Einstein degeneracy, the average occupation number of a single particle state with momentum p approaches infinity as $p \rightarrow 0$. ***T. D. Lee and C. N. Yang.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 897-920.

9718 Antiferromagnetic Structure of CrN. Chromium nitride, crystallizing with the rock salt structure, has been found to be antiferromagnetic with a Néel point of O C. The structure is orthorhombic below the transition and the space group *Pnma* has been tentatively assigned. The atomic displacements accompanying the distortion have been partially determined from the diffraction data and are discussed in relation to the magnetic structure. ***L. M. Corliss, N. Elliott, and J. M. Hastings.*** *Physical Review*, v. 117, 2nd ser., no. 4, Feb. 15, 1960, p. 929-935.

9719 Irreversible Thermodynamics and Continuum Mechanics. Using the basic conservation principles and the principles of irreversible thermodynamics, the fundamental equations and constitutive relations are obtained for fluids, solids, and visco-elastic media. Equations for the entropy production and heat conduction are derived for various special media and for a general medium having internal constraints. ***A. Cemal Eringen.*** *Physical Review*, v. 117, 2nd ser., no. 5, Mar. 1, 1960, p. 1174-1183.

9720 Strong-Coupling Limit in the Theory of Superconductivity. The Hamiltonian used by Bardeen, Cooper, and Schrieffer in their theory of superconductivity is studied in the

strong-coupling limit. The complete set of energy levels can be found by using group theory, even for a finite system. An expression for the grand partition function can immediately be written down, and this expression can be evaluated in a simple manner for a large system. ***D. J. Thouless.*** *Physical Review*, v. 117, 2nd ser., no. 5, Mar. 1, 1960, p. 1256-1260.

9721 Drift Velocity of Electrons in Nitrogen, Helium, Neon, Argon, Krypton, and Xenon. Accurate values of electron drift-velocity in purified noble gases and N have been obtained by measuring the transit time of photoelectrons across the gap of a parallel-plate condenser. Drift velocities in pure Kr and Xe had not been measured before. ***J. C. Bowe.*** *Physical Review*, v. 117, 2nd ser., no. 6, Mar. 15, 1960, p. 1411-1415.

9722 Irreversibility of Systems Perturbed by Random Forces. The irreversibility of quantum mechanical systems perturbed by random forces is investigated by means of phenomonological equations derived from the Schrödinger equation. A semiquantitative discussion depending on an assumption of time reversal symmetry of the ensemble of random functions leads to a description of the irreversibility of a system with a finite number of states. ***Vernon E. Derr.*** *Physical Review*, v. 117, 2nd ser., no. 6, Mar. 15, 1960, p. 1421-1425.

9723 Piezoresistivity in the Oxide Semiconductor Rutile (TiO_2). The fourth-rank piezoresistive tensor for the D_{4h} tetragonal symmetry of rutile may be expressed in terms of seven piezoresistive coefficients. Room-temperature values for these coefficients are presented for different resistivity material in the range from approximately 1000 to 0.1 ohm cm. ***Lewis E. Hollander, Jr., T. J. Diesel, and Gerald L. Vick.*** *Physical Review*, v. 117, 2nd ser., no. 6, Mar. 15, 1960, p. 1469-1472.

9724 Electric Field Induced Light Absorption in CdS. A shift of the band edge in CdS has been brought about by application of a high electric field to CdS crystals. High fields are produced at the rectifying junction between a conducting CdS crystal and an electrolyte solution. A shift of the band edge of 70 A was observed for an applied emf of 120 volts. ***Richard Williams.*** *Physical Review*, v. 117, 2nd ser., no. 6, Mar. 15, 1960, p. 1487-1490.

9725 The Measurement of Electron Temperature in High Temperature Plasmas. The method is based on the simplifying features of helium-like ions and on the rapid establishment of equilibrium between the processes of populating and de-populating the 2^3P_2 level. The intensities of CV and BIV lines from SCEPTRE IIIA were measured with a combination of a monochromator and a photomultiplier. The results suggest that any existing departure from a Maxwellian distribution of electron velocities did not seriously affect the value of electron temperature derived by this method. ***R. V. Williams and S. Kaufman.*** *Physical Society, Proceedings*, v. 75, pt. 3, Mar. 1960, p. 329-336.

9726 Resistance-Strip Magnetic Photomultiplier for the Extreme Ultraviolet. The performance of a windowless resistance-strip magnetic multiplier for detection of extreme ultraviolet is described. The detector is characterized by a high spectral sensitivity for wavelengths below 1400 A and a low sensitivity to longer wavelength radiation. The photomultiplier can be operated as a photoelectron counter with a well-defined counting plateau for pressures below 10^{-4} mm Hg. ***L. Heroux and H. E. Hinteregger.*** *Review of Scientific Instruments*, v. 31, Mar. 1960, p. 280-286.

9727 Double-System Recording and Editing With Video Tape. It is customary in the motion-picture industry to record and edit sound and picture separately. The procedure described affords vastly improved production flexibility over single-system methods. This added flexibility can also be used to considerable advantage with video tape. ***Oscar F. Wick.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Mar. 1960, p. 164-166.

9728 Solid State Physics. Advances in Research and Applications. Positron annihilation in solids and liquids, diffusion in metals, wave functions for electron-excess color centers in alkali halide crystals, the continuum theory of stationary dislocations, theoretical aspects of superconductivity are discussed. ***Frederick Seitz and David Turnbull, editors.*** v. X. 516 pp. 1960. Academic Press, New York. (QC125 So44)

9729 Solid State Physics. Supplement 2. Paramagnetic Resonance in Solids. The theory of the crystalline field; paramagnetic resonance spectra of the transition elements in single crystals; relaxation times and line width; paramagnetic resonance of color centers and defects in crystals; and paramagnetic resonance spectrometers are discussed. ***William Low.*** 212 pp. 1960. Academic Press, New York. (QC125 So44)

9730* Industrial Pipe Insulation at Higher Temperatures. Discusses experiments and equipment for the measurement of heat conductivity in pipe insulation materials between room temperature and 600 C. The components of the heat conductivity are discussed, and the variations with temperature and density are shown in diagrams for each of the components. A method is shown for more accurate calculation of the heat loss from insulated pipes. (*In Norwegian.*) Industriell rørisolasjon ved høyere temperaturer. ***Kjell Rydland.*** *Teknisk Ukeblad*, v. 107, no. 17, Apr. 28, 1960, p. 355 + 4 pages.

9731 Theory of Elementary Particles. The four-dimensional orthogonal group; field equations; quantization of fields; invariance properties and selection rules; isobaric space are discussed. ***Paul Roman.*** 575 pp. 1960. Interscience Publishers, New York. (QC721 R66t)

9732 Transactions of the Society of Rheology. Rheology of peeling in a Newtonian liquid, dynamic mechanical properties of fluorochemical elastomers, a torsion pendulum for dynamic and creep measurements of soft viscoelastic materials, the dynamic mechanical properties of a model filled system: polyisobutylene-glass beads, a photographic study of liquid flow in a roll nipp, on relaxation spectra in high polymers, approximate equations for interconverting the various mechanical properties of linear viscoelastic materials and other problems are discussed. ***R. D. Andrews, editor.*** Society of Rheology, Transactions, v. 2, 314 pp. 1958. Interscience Publishers, New York. (QC189 So13t Vis.)

9733 Wave Propagation and Group Velocity. The propagation of light in dispersive media; propagation of electromagnetic waves in material media; wave propagation in a dispersive dielectric; waves in wave guides and other examples. ***Léon Brillouin.*** 154 pp. 1960. Academic Press, New York. (QC661 B76wp)

9734* Investigation of the Decay of Bi^{212}(ThC)$\xrightarrow{\beta}$$Po^{212}$($ThC'$)$\xrightarrow{\alpha}$$Pb^{208}$(ThD) by Means of ($\gamma$, α)-Coincidences. The γ-spectrum of Po^{212} (ThC') has been measured by (γ, α)-coincidences with a fast-slow coincidence apparatus. The results are in excellent agreement with the conversion lines found by the Latyshev group. The absolute γ-intensities have also been determined in order to get spins and parties of the levels by calculating the absolute conversion coefficients. (*In German.*) Untersuchung des Zerfalls $Bi^{212}(ThC)\xrightarrow{\beta}Po^{212}(ThC')\xrightarrow{\alpha}Pb^{208}(ThD)$ durch (γ, α)-Koinzidenzen. ***Ulrich Hauser and Werner Kerler.*** *Zeitschrift für Physik*, v. 158, no. 4, 1960, p. 405-416.

See also: **9280** (satellite reaction to Earth's magnetic field).

PLASTICS

9735 New Polymers—New Problems. Several organic and inorgano-organic polymers are compared with structural metals and ceramics with regard to the properties which make the materials useful for construction of buildings, machines, and articles for daily use. The strength of metals and ceramics is, on the average, 20 times larger than that of polymers, but their elongation to break is correspondingly smaller. Another important property is the weight of a building material per unit of volume. Therefore, in terms of providing the strongest connections per pound of material used, the organic polymers are on top of the list of all existing substances. Polymers are subject to softening and decomposition at elevated temperatures which is a disadvantage in many applications. Several factors are discussed which may lead to the discovery of new polymers with rigidity, strength, and high melting characteristics. These factors are high molecular weight, orientation of the chains, rigidity of the

chains, presence of attractive groups, and regular distribution of these groups. ***H. F. Mark.*** *ASTM Bulletin,* no. 245, Apr. 1960, p. 31-34.

9736 Measurement of Environmental Stress-Cracking of Polyethylene. The improvement of the interlaboratory precision of the environmental stress-cracking method and the extension of understanding of the significance of the test results so as to carry out the test method most efficiently, make the best use of the results, and avoid applying the test data where they could be inappropriate is discussed. ***A. Rudin and A. M. Birks.*** *ASTM Bulletin,* no. 245, Apr. 1960, p. 60-65.

9737* Stereoregular Polymers. Polyethylenes and polypropylenes are discussed along with their properties. ***D. C. Blackley.*** *Applied Plastics,* v. 3, May 1960, p. 20-25.

9738 Atomic Radiation and Polymers. A review of scientific papers and short articles that have been published and cover the changes produced in materials by atomic radiation from reactors, or by electron radiation from high-voltage sources. All aspects of the subject, from commercial production of new types of polymeric material to fundamental studies impinging directly on reactor design, radiobiology, radiation chemistry and solid-state physics are discussed. ***A. Charlesby.*** v. I. 556 pp. 1960. Pergamon Press, New York. (QD601 C38a)

9739 Copolymers of Methylmethacrylate and Styrene for Moulding and Extrusion. Copolymers of methylmethacrylate and styrene capable of fulfilling requirements normally satisfied by polymethylmethacrylate have been developed and are commercially available. A copolymer with approximately 60% methylmethacrylate has proved to be remarkably suitable for a number of acrylic-type applications. The development of mass or continuous thermal polymerization methods for this copolymer is rendered difficult by several basic properties of the material, including the sensitivity of the polymerization reaction to impurities, the highly viscous nature of the fluid material, and the susceptibility to decomposition of the material at temperatures necessary to permit molten polymer transfer. Most of the properties of the copolymer are intermediate between the two polymers. The elongation at break and the softening point are higher in the copolymer, and the Young's modulus is lower. The resistance of this copolymer to a wide range of organic and inorganic compounds has been observed. The presence of the styrene has the effect of improving the resistance of the product to both acids of medium strength and to alcohols in general. The light stability of these materials has proved to be surprisingly good as indicated by accelerated aging tests and by outdoor tests. ***T. E. Davies.*** *British Plastics,* v. 33, May 1960, p. 195-198.

9740 Long-Term Stress Resistance of Resin/Glass Laminates in Different Environments. The flexural strengths of laminates bonded with different resins and tested in varying environments are compared. The effect of water on long-term strength is particularly noticeable when glass fibre is the filler and suggestions are made to counteract this behavior. ***J. J. Millane.*** *British Plastics,* v. 33, May 1960, p. 199-202.

9741 British Plastics Year Book 1960. A Classified Guide to the Plastics Industry. Contains technical terms, plastics properties, raw materials, manufactured products, plants, and equipment used in the plastics industry. v. XXX. 692 pp. 1960. Iliffe & Sons Ltd., London. (T12.G7 B77.6)

9742 Oxide Coat Toughens Metal-Plastic Bond. Polyethylene molded directly on oxide-coated metal gives unusually high bond strength. *Chemical and Engineering News,* v. 38, no. 16, Apr. 18, 1960, p. 96.

9743* Physico-Chemical Investigation on Chloroform Solution of Polycarbonate. Some physico-chemical properties of polycarbonate in chloroform solution were studied by viscosity measurements and by diffused light intensity at the "Flory temperature" of the solutions. Results are discussed after the Flory-Fox theory. (*In Italian.*) Ricerche chimico-fisiche su soluzioni di policarbonato in cloroformio. ***Aurelio De Chirico.*** *Chemica e l' Industria,* v. 42, Mar. 1960, p. 248-251.

9744 Encapsulating With Alkyd. Automation and miniaturization often require encapsulating components. The unit is isolated electrically and thermally and protected from moisture and physical damage. The process used with alkyd molding compounds is now standardized. ***J. J. Moylan and J. T. Long.*** *Electronic Industries,* v. 19, May 1960, p. 76-78.

9745 Some Reactions of Ferric Salts in Vinyl Polymerizations. In the termination of growing polymer radicals by ferric salts in N,N-dimethylformamide solution, predominantly saturated polymer is produced and different salts vary greatly in reactivity. Inhibition of the polymerization of methyl methacrylate and styrene by ferric bromide was examined. ***E. R. Entwistle.*** *Faraday Society, Transactions,* v. 56, Feb. 1960, p. 284-293.

9746* The Chemistry of Coordinate Polymerization of Dienes. A study of the polymerization mechanisms with regard to the varying ionic and coordinate influences of the catalysts. ***Max Roha.*** *Fortschritte der Hochpolymeren-Forschung,* v. 1, no. 4, 1960, p. 512-539.

9747* The Synthesis of Non-Random Copolymers by the Gamma Irradiation of Emulsion Systems. II. Non-random copolymers were synthesized by irradiation of vinyl monomers emulsified in polymeric lattices. Reaction products were resolved by either fractional precipitation or fractional solution. ***P. Hayden and R. Roberts.*** *International Journal of Applied Radiation and Isotopes,* v. 7, no. 4, Feb. 1960, p. 317-322.

9748 Structure of Certain Polyazaindenes. V. Syntheses. Syntheses of 6-methyl-4-oxo-1,3,3a,7-tetrazaindene, 4-methyl-6-oxo-1,2,3a,7-tetrazaindene, the methylation product of the latter, and a number of related substances are reported. The chemical evidence furnishes independent corroboration of the structures deduced by other methods. ***C. F. H. Allen, G. A. Reynolds, J. F. Tinker, and L. A. Williams.*** *Journal of Organic Chemistry,* v. 25, Mar. 1960, p. 361-366.

9749 Electron Exchange Polymers. XIII. The Preparation of β-Vinylanthraquinone. Synthesis from 2-methylanthraquinone. ***Miguel Fernandez- Refojo, Yue-Liang Pan, Kenneth A. Kun, and Harold G. Cassidy.*** *Journal of Organic Chemistry,* v. 25, Mar. 1960, p. 416-418.

9750 Thermally Stable Hydrocarbon Polymers: Polyterephthalylidenes. Polymer containing terephthalylidene repeating units were prepared by condensation polymerization employing the Knoevenagel reaction. Thermal stabilities of the polymers were interpreted on the basis of weight loss data and the change in the infrared spectra on pyrolysis. Thermal degradation at 550° resulted in a weight loss of less than 30% and the formation of a stable polymeric residue. ***Robert W. Lenz and Carl E. Handlovits.*** *Journal of Organic Chemistry,* v. 25, May 1960, p. 813-817.

9751 Wetting of Poly-(Methyl Methacrylate) and Polystyrene by Water and Saliva. The wetting properties of poly-(methyl methacrylate) and polystyrene in contact with distilled water and saliva were determined by contact angle measurements. ***R. G. Craig, G. C. Berry, and F. A. Peyton.*** *Journal of Physical Chemistry,* v. 64, May 1960, p. 541-543.

9752* Calculation of Nonbonding Forces as Applied to Stereospecific Polymerization. The nonbonding interactions were calculated for four models resembling types of propylene polymerization. The calculations predict syndiotactic polymerization for a radical or carbonium ion model and suggest isotactic polymerization for anionic-type reaction. ***L. L. Ferstandig and F. C. Goodrich.*** *Journal of Polymer Science,* v. 43, Apr. 1960, p. 373-381.

9753* Two Different Polymerization Mechanisms of Acrylonitrile Initiated by γ-Irradiation. The polymerization of acrylonitrile induced by ionizing radiation was investigated in bulk in the temperature range 15 to −196 C. It was found from this investigation that two different mechanisms could exist in the polymerization under the same conditions in different temperature regions. The two polymerization phenomena at room and at very low temperatures were studied from the point of view of radical and ionic polymerization mechanisms. ***Hiroshi Sobue and Yoneho Tabata.*** *Journal of Polymer Science,* v. 43, Apr. 1960, p. 459-465.

9754* Copolymerizability of Vinylpyridines. The copolymerizations of 2-vinylpyridine, 4-vinylpyridine, and 5-ethyl-2-vinylpyridine with styrene methyl methacrylate, and methyl acrylate were investigated. ***Takashi Tamikado.*** *Journal of Polymer Science,* v. 43, Apr. 1960, p. 489-500.

9755* Adsorption Studies With Polymers and Ion-Exchange Resins. The inert behavior of the polymer obtained by condensing cashewnut shell liquid (CNSL) with acid and

formalin was further investigated. The results substantiate the earlier findings that the polymer is inert in character. ***N. Krishnaswamy and B. D. Dasare.*** *Journal of Scientific & Industrial Research*, v. 19B, Jan. 1960, p. 32-33.

9756* Evaporation of Ingredients From Polymers. Rate of evaporation of phenyl-β-naphthylamine from a rubber plate determined with respect to the velocity of the gas current passing over the plate, to the plate thickness and to the initial concentration of the ingredient. A mechanism advanced for the vaporization process of ingredients from polymers is confirmed by the corresponding theoretical calculation. (*In Russian.*) Uletuchivanie ingredientov iz polimerov. ***L. G. Angert, A. I. Zenchenko, and A. S. Kuz'minskiĭ.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 1, Jan.-Feb. 1960, p. 1-8.

9757* The Emulsion Polymerization of Styrene in the Presence of Emulsifiers of Varying Molecular Weights. Effect of the molecular weight of emulsifiers on the rate of the emulsion polymerization of styrene and on the molecular weight of the polymer. Retardation of the polymerization process observed after reaching the maximum is associated with change in the colloidal properties of the emulsifier. Up to a given limit the intrinsic viscosity of polymer solutions increases with the molecular weight of the emulsifier. (*In Russian.*) Emul'sionnaia polimerizatsiia stirola v prisutstvii emul'gatorov razlichnogo molekuliarnogo vesa. ***N. Ia. Ivanova, and A. I. Iurzhenko.*** *Kolloidnyĭ Zhurnal*, v. 22, no. 1, Jan.-Feb. 1960, p. 37-41.

9758* Investigations Into the Strength of H.F. Welded Seams in PVC Sheeting. Influence of plasticizer content and thickness of the sheeting, the welding pressure, the shape and type of electrode on the strength of the welded seams in the case of plasticized PVC sheeting have been investigated. (*In German.*) Untersuchungen über die Festigkeit von Hochfrequenz-Schweissnähten an PVC Folien. ***S. Wintergerst.*** *Kunststoffe*, v. 50, Mar. 1960, p. 145-148.

9759* Properties, Processing and Fields of Application of Reinforced Plastics. Report of the symposium on reinforced plastics which was recently held at the British Plastics Federation. (*In German.*) Eigenschaften, Verarbeitung und Anwendungsgebiete verstärkter Kunststoffe. ***Max Hagedorn.*** *Kunststoffe*, v. 50, Mar. 1960, p. 168-173.

9760 General Formula for Creep and Rupture Stresses in Plastics. A general formula using the parameter K may be employed to predict rupture and creep properties of plastics materials under varying conditions of time and temperature. ***S. Goldfein.*** *Modern Plastics*, v. 37, no. 8, Apr. 1960, p. 127 + 7 pages.

9761 Structure Versus Elevated Temperature Performance of Epoxy Resins. ***J. Wynstra, A. G. Farnham, N. H. Reinking, and J. S. Fry.*** *Modern Plastics*, v. 37, no. 9, May 1960, p. 131 + 4 pages.

9762 Behaviour of Some Aldehydes on a Sulphonated Polystyrene Resin. ***S. A. Barker, K. Murray, and M. Stacey.*** *Nature*, v. 186, May 7, 1960, p. 469-470.

9763* New Methods of Testing Polyvinyl Chloride for Susceptibility to Pasting. A description is given of working methods designed to test PVC for susceptibility to pasting by a standard plasticizer in connection with investigations of PVC charges of different grain size distribution, surface condition, etc. (*In German.*) Neue Wege zur Prüfung von Polyvinylchlorid auf Verpastbarkeit. ***F. Böhme and K. Müller.*** *Plaste und Kautschuk*, v. 7, Mar. 1960, p. 124-127.

9764* Measurement of Compressibility of High Polymers as a Function of Pressure. The linear compressibility of high polymers as a function of hydrostatic pressure is determined within the range of 50 to 4500 kp/cm^2 at room temperature. The change of length of the test specimen produced by the pressure is determined by a change of capacity. The investigation includes dederon, ekafluvin, epoxy resin, plexiglas and others. (*In German.*) Messung der Kompressibilität von Hochpolymeren in Abhängigkeit vom Druck. ***K. Kröber.*** *Plaste und Kautschuk*, v. 7, Mar. 1960, p. 128-131.

9765* Effects of Secondary Plasticizers on Processing of Vinyls. I. ***P. D. Sharpe.*** *Plastics Technology*, v. 6, May 1960, p. 46-49.

9766* 'Plastovac-P' PVC Sheet for Vacuum Covering. "Plastovac-P" has the following advantages: wholly polymeric plasticizers to prevent migration into adhesive; emboss retention at high temperatures; preshaped surfaces in metal, wood, fiber board, plastics and other materials can be covered without loss of embossed effect; high abrasion resistance; easily cleaned with warm soapy water. Decorative effects, physical and chemical properties, plasticizers, and forming processes are discussed. *Rubber and Plastics Age*, v. 41, Apr. 1960, p. 376 + 2 pages.

9767* Polyurethane Foams. I. Basic Equipment for Flexible Foams. ***J. M. Buist.*** *Rubber Journal and International Plastics*, v. 138, no. 14, Apr. 2, 1960, p. 500 + 3 pages.

9768* Plastics in Cables. II. PVC Cables and Properties. Physical, low-temperature, aging and electrical properties are discussed along with flame, weathering, heat, and oil resistances. ***W. S. Penn.*** *Rubber Journal and International Plastics*, v. 138, no. 19, May 7, 1960, p. 682 + 3 pages.

9769* The Extrusion of High Density Polyethylene Tubing and Profiles. The utilization of high density polyethylene profiles and tubing has just begun to be exploited in areas where stiffness, toughness, abrasion resistance and chemical inertness properties are required. Advantages are also gained in reduction of material costs per foot of extrusion due to the lower price per pound of high density polyethylene resin vs. nylon or butyrate resins. ***D. J. Schmidt.*** *SPE Journal*, v. 16, May 1960, p. 505 + 3 pages.

9770* Heat Resistant Reinforced Laminates. The preparation of glass-reinforced laminates with excellent physical and electrical properties, using a specially-designed phenolic resin. ***John Miglarese.*** *SPE Journal*, v. 16, May 1960, p. 518 + 4 pages.

9771* The Interaction of Processing Variables, Base Materials, and Resins in Polyethylene Extrusion Coating. The effects of processing variables on the adhesion and heat seal properties of six polyethylene resins coated to each of five base materals: kraft paper, MSAD-80 and "K" type cellophane, Mylar, and aluminum foil. ***J. P. Goslin and H. F. Sweeney.*** *Tappi*, v. 43, May 1960, p. 434-447.

9772* α-Methylstyrene-Butadiene Copolymers With Predominant Vinyl Comonomer Content. It was found that polymerization ceases after consumption of the butadiene and a more precise method of calculating this "polymerization limit" has been proposed. The copolymer composition has been calculated both with the aid of the basic equation as well as of the approximate equation proposed by Soviet authors. (*In Russian.*) Sopolimery α-metilstirola s butadienom s preobladaniem vinil'nogo monomera. ***Ya. N. Prokofiev, M. I. Farberov, and V. A. Shadricheva.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 2, Feb. 1960, p. 185-192.

9773* Relation Between the Molecular Weight of Polyethyleneterephthalate and the Viscosity of Its Solutions in Phenol-Dichloroethane Mixtures. A new solvent of polyethyleneterephthalate dissolving the latter at room temperature has been proposed. The k' coefficient of Huggin's equation for concentration dependence was found equal to 0.42. (*In Russian.*) Sootnoshenie mezhdu molekuliarnym vesom polyetilentereftalata i viazkost'iu ego rastvorov v smesi fenola a dikhloretanom. ***E. V. Kuznetsov, A. O. Vizel, I. M. Shermergorn, and S. S. Tyulener.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 2, Feb. 1960, p. 205-209.

9774* Studies on Diffusion Processes in Polymers. I. Diffusion of Monoatomic Gases Through Polymer Films of Different Structure. The diffusion of He and Ar through polyethylene, polyvinylchloride, polyamide 54/10, methylolpolyamide 2/10, polytetrafluoroethylene and butadiene—30% styrene (SKS-30) has been studied at various temperatures with the aid of Daynes' manometric method. The assumption that the diffusion constants of Ar diminish in value with growing intermolecular interaction has been confirmed. (*In Russian.*) Issledovanie diffuzionnykh protsessov v polimerakh. I. Diffuziia odnoatomnykh gazov cherez polimernye plenki razlichnoĭ struktury. ***N. S. Tikhomirova, Yu. M. Malinskiĭ, and V. L. Karpov.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 2, Feb. 1960, p. 221-229.

9775* Synthesis and Polymerization of Arylphosphonitriles and Alkylphosphonitriles. The reaction of diaryl- and dialkylphosphotrichlorides and ammonium chloride in organic solvents has been investigated. Various products have been shown to form, depending upon the conditions of the reaction.

At 175 C and with excess ammonium chloride octaphenyltetraphosphonitrile is formed. (*In Russian.*) Sintez i polimerizatsiia fosfonitrilarilov i fosfonitrilalkilov. ***V. V. Korshak, I. A. Gribova, T. V. Artamonova, and A. N. Bushmarina.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 3, Mar. 1960, p. 377-385.

9776* Studies in Coordination-Chain Polymers. III. Coordination Polymers on the Basis of *bis*-(8-Hydroxy quinolyl)methane. The synthesis and properties of the coordination polymers of *bis*-(8-hydroxyquinolyl)methane with Zn, Cu, Mn, Ni, Co or Cd have been described. Mixed zinc-copper and zinc-cadmium coordination polymers with *bis*-(8-hydroxyquinolyl)methane and *bis*-(8-hydroxyquinolyl)methane–quinizarin with Zn, Cu, Ni, Co or Mn have also been prepared. (*In Russian.*) Issledovanie v oblasti koordinatsionnykh polimerov. III. O koordinatsionnykh polimerakh na osnove bis-(8-oksikhinolil)metana. ***V. V. Korshak, S. V. Vinogradova, and T. M. Babchinitser.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 4, Apr. 1960, p. 498-507.

9777* Investigation of the Polycondensation of Polyethyleneterephthalate and Polyorganoethoxysiloxanes. It has been found that this reaction leads to polymers with satisfactory mechanical and dielectric properties. A study of the thermal stability of the polymer showed it to be at a high level. (*In Russian.*) Issledovanie reaktsii polikondensatsii polietilentereftalata i poliorganoetoksisiloksanov. ***K. A. Andrianov, O. I. Gribanova, A. G. Pretkova, N. N. Sokolov, and Sun' Shumen.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 4, Apr. 1960, p. 521-525.

9778* New Vinyl Ether Polymers. The polymerization of vinyl-n-butyl, vinyl iso-butyl, vinyl isopropyl, vinyl cyclohexyl, and vinyl β-decalyl ethers in the presence of catalysts prepared from $TiCl_4$ and $Al(C_2H_5)_3$ has been carried out in toluene solution from −75 to −78 C. The isolated polymers have been characterized by their viscosities, solubilities and thermomechanical curves. (*In Russian.*) Novye polimery prostykh vinolovykh efirov. ***A. V. Bogdanova.*** *Vysokomolekuliarnye Soedinenia*, v. 2, no. 4, Apr. 1960, p. 576-580.

9779* Investigation of Polymer Polydispersity by the Method of Unestablished Sedimentation Equilibrium. II. Investigation of Polyisobutylene, Obtained by a Metallorganic Catalyst. (*In Russian.*) Issledovanie polidispersnosti polimerov metodom neustanovivshegosia sedimentatsionnogo ravnovesiia. II. Issledovanie poliizobutilena, poluchennogo s kompleksnym metalloorganicheskim katalizatorom. ***S. Ya. Frenkel', A. V. Topchiev, B. A. Krentsel', and Yu. Yu. Gol'dfarb.*** *Zhurnal Fizicheskoĭ Khimii*, v. 34, no. 2, Feb. 1960, p. 327-334.

See also: **8716** (plastic forms for concrete); **8740** (propylene in the resin industry); **8763** (performance of extruded plastic pipe); **8942** (epoxy resins).

POLLUTION AND WASTES

9780* Industrial Zoning as a Means of Controlling Area Source Air Pollution. ***William D. Holland, Akira Hasegawa, James R. Taylor, and Erwin K. Kauper.*** *Air Pollution Control Association, Journal*, v. 10, no. 2, Apr. 1960, p. 147 + 9 pages.

9781* Symposium on Polycyclic Hydrocarbons. Papers presented at the Air Pollution Symposium, Atlantic City, N. J., September 17, 1959. *International Journal of Air Pollution*, v. 2, no. 3, Mar. 1960, p. 201-282.

9782* Air Pollution Bibliography. *T. F. Hurley, compiler.* *International Journal of Air Pollution*, v. 2, no. 3, Mar. 1960, p. 291-298.

9783* Treatment of Organic Wastes in Aerated Lagoons. Principal objections to lagooning are odors in the surrounding area and the large capacity requirements dictated by the comparatively low rate of oxidation under anaerobic conditions. These objections may be overcome by the installation of diffused or mechanical aeration systems in the lagoon. ***Donald J. O'Connor and W. Wesley Eckenfelder, Jr.*** *Water Pollution Control Federation, Journal*, v. 32, Apr. 1960, p. 365-382.

9784* Forecasting Heat Loss in Ponds and Streams. Large quantities of condenser and cooling water used in the modern fuel power generating stations, nuclear reactors, and industries raise the temperature of the water course substantially above normal levels. This affects the natural waste assimilation capacity of the stream and the normal aquatic life, and may interfere with subsequent downstream uses. ***C. J. Velz and J. J. Gannon.*** *Water Pollution Control Federation, Journal*, v. 32, Apr. 1960, p. 392-417.

See also: **8754** (sulfuric acid mist removal); **8762** (industrial waste water); **9206** (tar decanter sludge recovery).

RUBBER AND ELASTOMERS

9785* Rubber Industry Greets the Urethanes. Reports production methods and properties. *Canadian Chemical Processing*, v. 44, May 1960, p. 53 + 2 pages.

9786* Dunlop's Propylene-Isoprenepolymer. This rubber polymer may significantly affect the oil refining, petrochemical and rubber industries. An alternating polymer of propylene and and isoprene was synthesized using conventional Lewis acid catalysts. Rubbery solids and resins produced in the Dunlop lab give rise to the promise of a new, cheap material for industry. *Canadian Chemical Processing*, v. 44, May 1960, p. 58 + 3 pages.

9787* Molecular Areas of Soaps at the Surface of Latex Particles. The molecular area has been determined for a number of anionic, cationic, and non-ionic emulsifiers, adsorbed on latex particles. Measurements were made by surface tension and electron microscopic techniques. ***R. J. Orr and L. Breitman.*** *Canadian Journal of Chemistry*, v. 38, May 1960, p. 668-680.

9788* Rubber Vulcanization by Gamma Rays. The effects of a number of additives and of the irradiation medium on the speed of curing by gamma rays was studied. The action of rays was enhanced by a chlorinated monomer (dichlorostyrene), a non-monomer halogenated derivative (Freon 113), a metal oxide (litharge) and a litherge/p-dichlorobenzene combination. (*In German.*) Vulkanisation von Kautschuk durch Gamma-Strahlen. ***G. Lamm, A. Lamm, and H. Madelaine.*** *Kautschuk und Gummi*, v. 13, Apr. 1960, p. 80WT-90WT.

9789* High Precision Tyres. An entirely new production control system, monitored by nuclear gauges and electronic "brains" is being employed by the Goodyear Tire & Rubber Co. to produce high precision tires. *Rubber and Plastics Age*, v. 41, Apr. 1960, p. 381-382.

9790* Carbon Blacks in Various Polymers. The effects of adding FEF, HAF, and MPC on the properties of natural and synthetic rubber. ***N. C. H. Humphreys.*** *Rubber Journal and International Plastics*, v. 138, no. 18, Apr. 30, 1960, p. 650 + 2 pages.

9791* Contrasts in the Response of Elastomers to High-Temperature Vulcanization. Elastomers studied include smoked sheet natural rubber, styrene-butadiene rubber (SBR), mixtures of smoked sheets and SBR, Enjay Butyl 215, nitrile-butadiene rubber (NBR), and neoprene. ***Frank B. Smith.*** *Rubber World*, v. 142, no. 1, Apr. 1960, p. 89-97.

9792 Effects of Brominated Butyl in Butyl Rubber Compounds. Factors affecting compounding and curing of butyl-brominated butyl rubber blends, and resultant vulcanizate properties evaluated. ***A. C. Bluestein and R. F. Grossman.*** *Rubber World*, v. 142, no. 1, Apr. 1960, p. 98-102.

9793* Properties of High-*trans* Polybutadiene. Basic properties and typical application trials indicate possible commercial uses of this balata-like material. High *trans* configuration in polybutadiene results in polymers which resemble balata and gutta percha, naturally occurring *trans*-polyisoprenes, in certain physical properties. Pilot-plant quantities of high-*trans* polybutadienes have been compared for evaluation in order to determine potential end-uses for such materials. Polymers having a *trans* configuration of approximately 90% have been designated Philprene X-10 and have been found to possess a versatile combination of properties including high hardness and modulus and relatively high tensile strength. Philprene X-10 rubbers are hard and boardy in the raw state at room temperature, but are thermoplastic and are therefore easy to mill, extrude, and mold at elevated (180 F and higher) temperatures. High *trans*-polybutadiene rubbers are vulcanizable with conventional sulfur-accelerator curing systems or with dicumyl peroxide. Gum stocks

prepared from Philprene X-10 display physical properties equivalent, and in some respects, superior to those of SBR, but are generally inferior to those of natural rubber. Black-reinforced Philprene X-10 vulcanizates are characterized by high modulus and Shore hardness and by excellent laboratory abrasion resistance. High-*trans* polybutadienes, alone and in admixture with other polymers, should find application in specialty items such as floor tile, gasket stocks, golf-ball covers, battery cases, shoe soles, and miscellaneous molded or extruded goods. ***H. E. Railsback, J. R. Haws, and C. R. Wilder.*** *Rubber World*, v. 142, no. 2, May 1960, p. 67-77.

9794* Non-Discoloring Promoters of Butyl Rubber-Reinforcing Silica Thermal Interaction. Phenol dialcohols, an organic sulfide, organic peroxides, and urea found to be effective. ***Ralph F. Wolf.*** *Rubber World*, v. 142, no. 2, May 1960, p. 81-86.

9795 Practical Solution of Plastic Deformation Problems in Elasticplastic Range. The method used is one of successive approximations and is illustrated by four examples which include a flat plate with temperature distribution across the width, a thin shell with axial temperature distribution, a solid cylinder with radial temperature distribution, and a rotating disk with radial temperature distribution. ***A. Mendelson and S. S. Manson.*** *U. S. National Aeronautics and Space Administration, Technical Report, NASA TR R-28*, 1959, 24 pp. (TL521 Un3ra Vis.)

9796* Mercurated Rubbers. I. Mercurated Butadiene Rubbers. A procedure for carrying out the reaction both homogeneously and heterogeneously has been proposed which leads to compounds of the type (rubber) OR·Hg $OCOCH_3$. Mercuration not only of the double bonds but also of the methylene groups has been observed. Transition of the rubbers from the amorphous to the crystalline state on mercuration has been noted. (*In Russian.*) Merkurirovannye kauchuki. I. Merkurirovannye butadienovye kauchuki. ***R. N. Smirnov.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 4, Apr. 1960, p. 558-562.

SPACE HEATING AND CONDITIONING

9797 Effect of Transient Loads on the Refrigerated-Space Temperature of a Cooling Complex. An analysis was carried out by treating transient effects of an insulated-wall structure having *actual* heat capacity, and with cyclically varying outdoor-air temperature as well as of solar-radiation effect on the exposed surfaces. Calculations and results are cited. ***Carl F. Kayan.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 82, no. 2, May 1960, p. 159-166.

9798* Centrifugal Fan Application Guide. I. Which Fan Will Work Best? Many engineers, in an attempt to avoid the complexities of the subject, rely on rules of thumb that often result in excessive costs. The author asks and answers the key questions that arise when a fan must be selected for air conditioning or ventilating duty. A suggested specification check list is appended. ***C. J. Trickler.*** *Air Conditioning, Heating and Ventilating*, v. 57, Apr. 1960, p. 56-63.

9799* Applying Weather Data to Greenhouse Cooling. Design outside temperatures for comfort conditioning do not properly apply to cooling greenhouses. The author tells what data the designer must get and how to calculate air and water requirements from them. ***C. P. Hedlin.*** *Air Conditioning, Heating and Ventilating*, v. 57, Apr. 1960, p. 76-78.

9800* Refrigerant Liquid Line Piping. The seventh of a series of articles dealing with various phases of refrigerant piping, with examples of poor and preferred piping arrangements is discussed. This article covers the parts of refrigerant liquid such as the many types of valves now in use. ***J. R. Harnish.*** *Air Conditioning, Heating and Ventilating*, v. 57, Apr. 1960, p. 91-95.

9801* Air Conditioning and Heating the Supermarket. Practical design information and an insight into some of the design problems that must be overcome. ***W. A. Zumbiel.*** *Air Conditioning, Heating and Ventilating*, v. 57, May 1960, p. 74-80.

9802* Unique Heating-Cooling Installation in New Reynolds Metals Building. This hollow-core building has movable office partitions, a waffle shaped concrete slab construction, balcony offices, all of which posed many problems for system design engineers. This article also compares gas vs. oil fuels, centrifugal vs. absorption refrigeration machines. ***Edwin C. Siegel.*** *Air Engineering*, v. 2, no. 4, Apr. 1960, p. 22 + 8 pages.

9803* How Well Can It Be Done With Todays Air Sanitation Methods? Beginning an authoritative review of methods used to combat spread of disease by airborne droplets. Hospitals are on the front line, but these findings apply equally well to schools and other public buildings. ***Melvin W. First.*** *Air Engineering*, v. 2, no. 4, Apr. 1960, p. 29-33.

9804* How to Balance Big Building Air Conditioning Systems. Gives methods of balancing the air distribution system that will assure owner satisfaction. Use of instruments for checking static pressure, air flow, and coil output is detailed. ***Sidney A. Littmann.*** *Air Engineering*, v. 2, no. 5, May 1960, p. 36-39.

9805 Solar Energy: Heat Source for Tomorrow's Heat Pump? Solar energy can be either in the form of direct radiation or as energy stored in the earth's crust. Test results are cited. Estimated heat load from weather data, and design of a solar collector are discussed. ***E. B. Penrod and K. V. Prasanna.*** *Heating, Piping & Air Conditioning*, v. 32, May 1960, p. 118-126.

9806 'Direct Throttling Is Good Hot Water Pressure Control'. Poor pressure control can be the downfall of hot water heating systems. Various pump bypass methods either do not take into account the falling pressure characteristic or cause some other operating shortcoming. Points out how pressures vary and suggests one method—direct throttling—for controlling them. ***J. W. Scharres.*** *Heating, Piping & Air Conditioning*, v. 32, May 1960, p. 132-134.

9807 How to Operate Induction Unit Systems When Changeover Point Is Subfreezing. The modified system facilitates use of the heat rejected into the condenser of the refrigerating machine for providing reheat to the primary air. Therefore, when the outdoor air temperature is below 40 F, the use of the cooling tower will not be necessary, eliminating the freeze-up problem. ***Hem C. Gupta.*** *Heating, Piping & Air Conditioning*, v. 32, May 1960, p. 137-140.

9808 Cryogenic Piping System Design and Installation. Considers areas where unique information, data or techniques are encountered. Included are the effects of low temperatures on fluid flow, pumping equipment, instrumentation, and fabrication and installation of the piping system. ***Robert B. Jacobs.*** *Heating, Piping & Air Conditioning*, v. 32, May 1960, p. 141-156.

9809* Australian Research Into Indoor Thermal Comfort. Australian research on indoor thermal comfort has been concerned with the performance of buildings under nonsteady temperature conditions. Up to the present stage, little or no work has been undertaken on the efficiency or the intermittent performance of heating and cooling equipment. ***R. W. Muncey.*** *Institution of Heating and Ventilating Engineers*, v. 27, Feb. 1960, p. 330-333.

9810* Off-Peak Electric Heating of Buildings by Hot-Water Methods. This paper has been written to show, in a practical manner, that hot-water systems heated by electricity off-peak can compete in the majority of cases with the direct electric off-peak systems and that the hot-water heating engineer need be at no disadvantage in the future development of off-peak electric heating. ***S. A. Williams.*** *Institution of Heating and Ventilating Engineers*, v. 27, Mar. 1960, p. 337-358.

9811* The Control of Heating and Ventilating Installations as Affected by Plant Design. The successful control of an installation depends as much on the installation itself as on the automatic controls supplied. The inherent stability of an installation and the effect of lag on performance is explained. The "fly-wheel" effect of heat capacity can be harnessed to simplify controls and improve results. ***C. L. Champion and F. M. B. Taylor.*** *Institution of Heating and Ventilating Engineers*, v. 27, Mar. 1960, p. 359-363.

9812* High-Velocity Air-Conditioning. The year-round controlled cooling, heating and ventilation, sealed double windows and other advantages are discussed. ***J. K. MacVicar, G. Gray, and J. Baxter.*** *Institution of Heating and Ventilating Engineers*, v. 28, Apr. 1960, p. 1-22.

See also: **9370** (piping systems); **9397** (water treatment).